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AN ASSESSMENT OF POTENTIAL  
MARKETS FOR THE DISER CORPORATION

PREPARED BY

INPUT LIMITED

FEBRUARY 1984

INPUT LTD  
AIRWORK HOUSE  
35 PICCADILLY  
LONDON W1V 9PB



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# AN ASSESSMENT OF POTENTIAL MARKETS FOR THE DISER CORPORATION

## CONTENTS

	<u>Page</u>
I. INTRODUCTION .....	1
A. Objectives	1
B. Scope and Methodology	2
1. Market Potential Study	2
2. User Study	2
3. Analysis of Competition	4
4. Comparative Company Financial Data	4
C. Report Structure	6
II. EXECUTIVE SUMMARY .....	7
A. Programmer Productivity Products	7
B. Opportunities in CAD/CAM Systems	8
C. Opportunities in Document Creation	9
D. The Users View of DISER	9
E. The Competitive Environment	10
F. Conclusions	11
G. Recommendations	12
III. MARKET ANALYSIS .....	13
A. Programmer Productivity Products	13
1. Programmer Productivity	13
2. Productivity Aids	20
3. MODULA-2	25
B. Specialist Market Opportunities	32
1. CAD/CAM	32
2. Document Creation	33
3. Vertical Markets	34
4. OEM Product Requirements	34
C. Market Size	36
IV. USER EXPERIENCE OF DISER .....	41
A. Strengths and Weaknesses	41
B. CERN	44
C. CNAM	45
D. EUROCONTROL	46
E. SULZER	48
F. SIGNETICS	49
G. UNIVERSITY OF COLORADO	50
V. COMPETITIVE ANALYSIS .....	52
A. Programmer Productivity Products	52
1. PERSPECTIVE	53
2. PRADOS	54
3. CODATA SYSTEM 3300	54
B. CAD/CAM Systems	55
C. Document Creation Systems	55

## CONTENTS (continued)

		<u>Page</u>
VI	CONCLUSIONS AND RECOMMENDATIONS .....	57
	A. Conclusions	57
	1. No market for Programmer Productivity Workstations	57
	2. Potential Specialist Markets Need Careful Selection	58
	3. MODULA-2; Strength and Weakness	58
	B. Recommendations	59
	1. Hardware Manufacturer or Software Supplier	59
	2. Selection of Business Goals	59
	a) Software House Capability	59
	b) MODULA-2 Programmer Workstation	60
	c) Specialist Markets	60
	3. Select Partners	60
APPENDIX	A. Comparative Company Financial Data	62
	A. Auto-Trol Technology Corporation	65
	B. Information Displays Inc.	69
	C. Convergent Technologies	75
	D. Cawdor	81
	E. Telemetrix	81
	F. Hytec	82
	G. Bleasdale Computers	82
	H. Micromite	83
	B. Competitive Equipment	84
	A. PERSPECTIVE	85
	B. PRADOS	92
	C. CODATA SYSTEM 3300	114
	D. Competitive Equipment Characteristics	124
	C. Completed Questionnaires : Market Potential	-
	D. Completed Questionnaires : User	-



# AN ASSESSMENT OF POTENTIAL MARKETS FOR THE DISER CORPORATION

## EXHIBITS

		<u>Page</u>
I-1	List of Respondents: Market Potential	3
-2	List of Respondents: Users	5
III-1	Potential Markets for the DISER system	14
-2	Software Development Manpower Diagram	16
-3	The Programming Part of Software Development Projects	17
-4	Attitudes Towards the Major Elements of Software Development	18
-5	The Measurement of Programmer Productivity	19
-6	Comments on the Use of a New Language for Development Purposes	21
-7	Productivity Expectation as Justification for Adoption of a New Language for Software Development	22
-8	Use of Software Development Languages within Respondent Sample	24
-9	Software Development Environment Requirements	26
-10	Attitudes towards use of MODULA-2 amongst Market Potential Respondents.	27
-11	Respondents' Comments on MODULA-2	30
-12	The Relative Perceived Rosition of Programming Languages	31
-13	Characteristics of OEM Respondents	35
-14	OEM Equipment Features	37/38
-15	Estimated Size Of Market Opportunities for DISER	39
IV-1	Most Valuable Equipment Features	42
-2	Users Perceived Deficiencies of DISER System	43
A-1	List of Comparative Company Financial and Commerical Data	63

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AUTHOR

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## I. INTRODUCTION



# I INTRODUCTION

## A. OBJECTIVES

- This report has been prepared by INPUT for the GENEVEST Consulting Group and their client the DISER Corporation. It is based on a research study conducted by INPUT with the specific objective of making an assessment of potential markets for the DISER Corporation.
- Two broad areas of market potential were defined:
  - The use of the DISER system as a programmer workstation.
  - The opportunity for DISER systems within other specialist markets, eg CAD/CAM, Business Graphics etc. that would most likely be addressed through OEM sales channels.
- The scope of the market research was broadly established at a meeting attended by representatives of GENEVEST, DISER, INPUT and other interested parties on January 16th 1984. It was further developed in the light of further research and discussions that took place between representatives of GENEVEST and INPUT.
- In addition to an overall assessment of potential markets for DISER this study's objectives included:
  - An assessment of user experience of DISER equipment.
  - An assessment of competitive equipment available in the market.
  - The collation of commercial and financial information on comparative companies that could be used by GENEVEST as the basis of a company valuation.

## B. SCOPE AND METHODOLOGY

### 1. Market Potential Study

- To assess the potential markets for DISER systems a field survey of 24 in-depth interviews was conducted. The list of respondent companies is shown in Exhibit I-1. Organisations were targeted within the Information Technology Industry that were perceived to have a high need for programmer productivity.
- Two major areas were identified. These were program development for embedded systems, and the development of product software.
- Additionally the potential for DISER systems to be used as the basis of OEM products was investigated.
- Careful consideration was given to the selection of respondents that would achieve a balance between program development functions and OEM potential and thus meet these criteria. In practice many organisations have interests in all these separate areas of activity.
- Four country markets were researched; the U.S., France, West Germany and the U.K. Six interviews per country.
- In considering the areas of program developemnt for embedded systems and the development of product software, the availability of cross-compilers to target machines has been assumed.
- Additionally the assumption has been made that the DISER product under consideration is that described as the DISER Modula Computer MC2 and defined in the DISER Corporation document, 'Software Improvements for Modula Computer Model 2.0'.

### 2. User Study

- To assess the experience of, attitudes to and potential amongst organisations which have installed a DISER system.

## EXHIBIT I-1

### LIST OF RESPONDENTS: MARKET POTENTIAL

#### U.K.

1. BRITISH TELECOM
2. FERRANTI
3. GEC
4. SYSTEMS DESIGNERS
5. SCICON
6. THORN-EMI

#### FRANCE

7. CIT-ALCATEL
8. GSI
9. STERIA
10. THOMPSON-CSF
11. SOPRA
12. CAP-GEMINI-SOGETI

#### WEST GERMANY

13. BRIGITTA-ELWERATH
14. HAMBURG MANNHEIMER VERSICHERUNGS
15. LOGOTEC
16. ZEDA
17. BERTHOLD AG
18. RACAL-REDAC

#### U.S.A.

19. BOEING COMPUTER SERVICES
20. MCAUTO
21. COMSHARE
22. NASTEC
23. EDS
24. CREATIVE HARDWARE DESIGN



- 6 in-depth interviews were conducted in three country markets, the U.S., France and Switzerland. Additionally two of the 'Market Potential' interviews conducted in the U.K. (Ferranti and GEC) had some experience of using DISER equipment which was useful in providing background to this analysis. The respondents are listed in Exhibit I-2.

### 3. Analysis of Competition

- Desk research based on INPUT's on-going research programmes and research resources was conducted to assemble information on products which could be broadly described as competitive to the DISER system.

### 4. Comparative Company Financial Data

- Desk research based on INPUT's on-going research programmes and research resources was conducted to assemble financial and commercial data on comparative companies.

## EXHIBIT I-2

### LIST OF RESPONDENTS: USERS

- |     |                        |
|-----|------------------------|
| 25. | CERN                   |
| 26. | CNAM                   |
| 27. | EUROCONTROL            |
| 28. | SULZER                 |
| 29. | SIGNETICS              |
| 30. | UNIVERSITY OF COLORADO |

## C. REPORT STRUCTURE

- The remaining chapters of this report are organised to provide the following information:
  - Chapter II contains the Executive Summary, which summarises findings and highlights key points.
  - Chapter III describes the analysis of the potential markets for the DISER Corporation. This covers the potential market for a 'programmer productivity' workstation and the other specialist market opportunities.
  - Chapter IV specifically addresses the area of user experience to date with DISER systems.
  - Chapter V describes the competitive product situation providing data which assists in an assessment of DISER's current market positioning.
  - Chapter VI describes INPUT's conclusions and makes recommendations for future action.
  - The appendices besides containing the completed questionnaires and an analysis of the respondent sample also contain the Competitor Value Analysis information referred to in Section B.4. above, and competitive product information referred to in Chapter V.

## II. EXECUTIVE SUMMARY



## II EXECUTIVE SUMMARY

- Two areas of the market were considered as marketing opportunities for DISER:
  - the market for Programmer Productivity products
  - Specialist Market Opportunities through OEM's, specifically CAD/CAM and Document Creation.

### A. PROGRAMMER PRODUCTIVITY PRODUCTS

- The market for programmer productivity products is not a good area of opportunity for DISER.
- Programmer productivity as opposed to overall software development productivity is a low key issue for the industry. Reasons for this are:
  - Programming is only one part of a complex software development project. Specification and design are considered to be the most important areas.
  - Productivity is difficult to measure and as a result is quite frequently not measured.
  - Software developer's choice of language is dependent on many factors. Programmer productivity is not a high priority issue in this respect, maintainability, reliability and the programming environment (tools, aids etc.) are.
- There was no indication of a strong requirement for individual programmer workstations. There was an indication that this attitude would change as the cost of equipment neared the \$5,000 mark. Currently available equipment is too expensive.
- The market for the DISER system as a programmer workstation is highly dependent on the use of MODULA-2.
- At this time MODULA-2 is not a widely used language and this severely limits the market potential.

- The attitude towards MODULA-2 in the marketplace polarises around two distinct positions:
  - For the software developer concerned primarily with applications development there is an attitude almost of hostility towards new languages. The currently accepted standards in the industry and the clearly established bandwagons are of the utmost importance to this type of software developer.
  - For those developing specialised software there is a completely open attitude towards new languages. This type of person is constantly looking for improvements and technical advantages which can be exploited. There are signs that MODULA-2 is making some progress in this market.

## B. OPPORTUNITIES IN CAD/CAM SYSTEMS

- This is a rapidly developing market that presents a considerable number of opportunities.
- DISER's entry to this market will be limited by the availability of specialised software and the need to meet emerging international graphics standards.
- It will be important to target those market segments where the hardware characteristics of the DISER system are appropriate. For example colour screens are mandatory for VLSI design.
- Approaches to the market via OEM's will be the most productive approach in order to limit the software costs of entry to selected specialist markets. These are likely to have a clear vertical market orientation.
- Attractive OEM pricing will have to be offered in this competitive market.



### C. OPPORTUNITIES IN DOCUMENT CREATION

- This is a market which is now showing signs of rapid development due to the driving force of low cost micro-computers, high resolution screens and laser printers.
- DISER have an opportunity to establish a position but careful targeting of market segments with a high need for manipulation of text, graphics and images will be needed. Market focus will be all important.
- Entry to this market will be facilitated by OEM agreements or other partnership arrangements. These will be necessary in order to gain detailed knowledge of the needs of the appropriate sub-markets and to lower the software costs of entry.
- It is also quite likely that the chosen market segments will be in specific vertical markets.

### D. THE USERS VIEW OF DISER

- Experience of the product is in general too limited to be able to make detailed comments backed up by strong evidence. Nevertheless a broad picture seems to emerge.
- The DISER system is liked because of its MODULA-2 capability, its screen and windowing capabilities that combine to give the user a good interface, and its printing capability.
- The system is however perceived as having a number of deficiencies in particular:
  - No access to FORTRAN libraries
  - No UNIX environment
  - No local Area Network
  - Limited memory and disk storage
  - Expensive
- The general impression gained was that the attitude to the DISER system was heavily influenced by its MODULA-2

capability. They were concerned that the machine had too narrow an appeal and that at the moment was unable to communicate with other machines.

#### E. THE COMPETITIVE ENVIRONMENT

- The competitive environment for DISER is fierce. The market is oversubscribed with suppliers.
- INPUT believes that a shake-out will occur within the next 2 or 3 years and only strong, viable companies with distinctive products meeting clearly identifiable market needs, will survive.
- In the Programmer Productivity market, the competitive position is being established by products like:
  - PERSPECTIVE from System Designers Limited. A complete software development environment for PASCAL.
  - PRADOS from SCS. Another complete software development environment.
  - CODATA 3300, a programming development tool offering a wide range of languages including MODULA-2 under a UNIX environment.
- In the specialised markets competition will be met from a wide variety of systems. Some examples are:

ADAGE	MEGATEK
APOLLO	MASSCOMP
AUTO-TROL	NBI
CADMUS	NCR
CALCOMP	PERKIN-ELMER
CHARLES RIVER	PIXEL
CHROMATICS	RESEARCH MACHINES
CTM	SIGMA
CONVERGENT TECHNOLOGIES	SUN
CORVUS	SYMBOLICS
DEC	WEST

DUAL  
HEWLETT PACKARD  
IBM  
ICL PERQ

- This list is not claimed to be exclusive. Details of competitive systems from some of these companies are included in an Appendix to this report.

## F. CONCLUSIONS

- INPUT has concluded from this study that there are few market opportunities for the DISER system as a programmer productivity workstation. Reasons for this relate to:
  - programmer productivity not being a key issue for complex system development.
  - the need for complete programming environments.
  - the limited acceptance of MODULA-2 to date.
- There is however a continuing opportunity in the university area and research environments where MODULA-2 has been accepted.
- Potential Specialist Markets exist for DISER in the CAD/CAM and Document Creation area.
- There are probably a number of conditions that DISER must meet in order to be able to tackle these markets effectively:
  - seeking out business partners and OEM agreements to lower the cost of entry to these markets.
  - provide competitive OEM pricing and discount structures.
  - provide a more widespread programming environment.
  - careful selection of target market areas probably within vertical markets.

- INPUT has concluded that MODULA-2 represents both a strength and a potential weakness for DISER.
- It is a strength in that it provides a distinguishing uniqueness in the market.
- It is a weakness because of the relatively limited acceptance of MODULA-2 in the market. There are some signs, however, that the use of MODULA-2 is growing in certain specific areas.

#### G. RECOMMENDATIONS

- INPUT recommend that DISER give very careful consideration to adopting a strategy that emphasises its unique strengths rather than dilutes them.
- These unique strengths relate to its software experience and expertise particularly with regard to MODULA-2.
- INPUT recommend that DISER's business and marketing goals be formulated around:
  - development of a Software House capability for complex software development and MODULA-2.
  - a continuation of the policy of targeting the university market with the DISER system to exploit the relatively high interest in MODULA-2 in this environment.
  - the pursuit of specialist market segments in CAD/CAM and Document Creation.
- INPUT recommends that DISER must seek partnership arrangements with other organisations in order to realistically tackle all these marketing goals.

### III. MARKET ANALYSIS





### III MARKET ANALYSIS

- Two broad areas of market potential were addressed in this study:
  - The market for programmer productivity products.
  - Specialist Market Opportunities that could be developed through OEM agreements.
- Exhibit III-1 provides a schematic overview of these two areas of the market.
- The market for programmer productivity products was considered (in the case of the DISER system) to lie at the complex, bare-micro end of the market and is classified into embedded and non-embedded systems.
- The potential Specialist or OEM market is restricted to those areas where the graphics and laser printing capabilities of the system are considered to have maximum potential.
- Each of these potential markets is examined in turn below.

#### A. PROGRAMMER PRODUCTIVITY PRODUCTS

##### 1. Programmer Productivity

- The existence of this market is based upon the assumption that software development organisations perceive a strong need for improvements in programmer productivity.
- The study results indicate that whilst overall software development productivity is a key issue in the industry, the actual programming element is not considered to be of high priority.
- The reason for this is that the actual programming task is only one element of the highly complex task of producing software. Its relative importance to other elements of the software development task is discussed below.



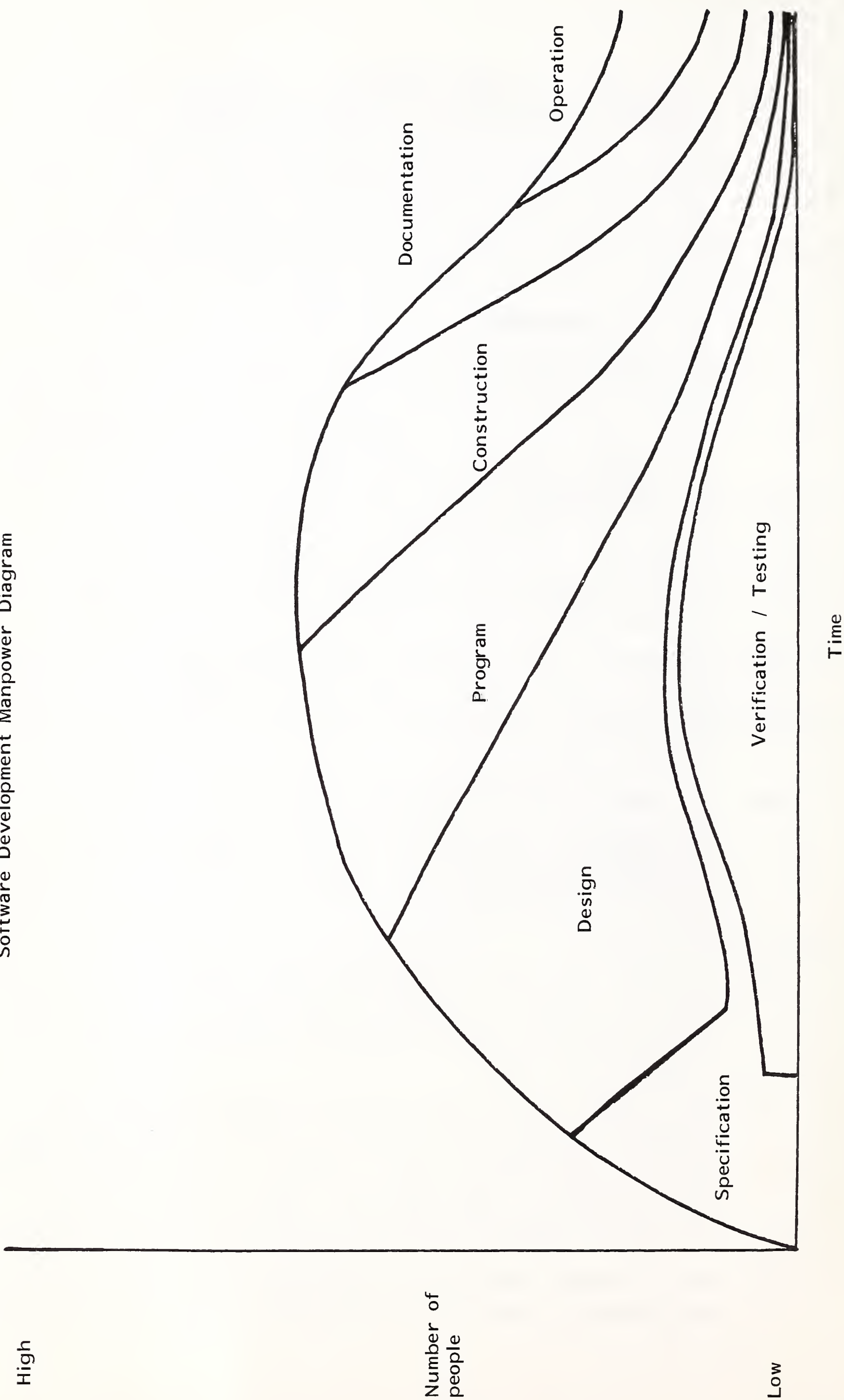
# EXHIBIT III-1

## POTENTIAL MARKETS FOR THE DISER SYSTEM

PROGRAMMER PRODUCTIVITY PRODUCTS		
Non-embedded -----	Military Commerical	<ul style="list-style-type: none"> <li>- University/Education</li> <li>- Research Labs</li> <li>- S/W Product Development</li> <li>- Other</li> </ul>
Embedded -----	Military Commerical	<ul style="list-style-type: none"> <li>- Telephone Industry</li> <li>- Consumer Goods</li> <li>- Process/Manufacturing Central</li> <li>- Robotics</li> <li>- Other</li> </ul>
SPECIALIST MARKET OPPORTUNITIES (For OEM Agreements)		
CAD/CAM -----		<ul style="list-style-type: none"> <li>- Integrated Circuit and Printed Circuit Board Design</li> <li>- Mapping</li> <li>- Mechanical Design</li> <li>- Civil Engineering</li> </ul>
Document Creation -----		<ul style="list-style-type: none"> <li>- Business Graphics</li> <li>- Image Processing</li> <li>- Typesetting in office automation</li> </ul>

- A software development project is generally considered to consist of a number of distinct but highly interrelated tasks. Various breakdowns can be used, Exhibit III-2 shows that used for the purposes of this study. This analysis is shown in the form of a manpower diagram. Naturally the relative proportions of the constituent elements will vary dependent upon the particular type of software development.
- The distribution of the relative proportion of the programming part of software development projects for the study sample is shown in Exhibit III-3. The average is under 40%. In general the larger the project the lower the percentage, and here programming can be as little as 10% of the overall effort as the management content increases. For small projects (eg 3-4 man years and below) the programming content typically increases to 50% and more.
- Respondents were asked to indicate the level of importance that they attributed to the various elements of software development. The results are shown in diagramatic form in Exhibit III-4.
- The conclusion can be drawn that whilst clearly programming is important, it is not the most important component of software development. Specification and design are generally considered to be the most critical components.
- Although there was no question that overall software development productivity was of the highest importance very few companies actually measured programmer productivity. (see Exhibit III-5).
- Only 31% of those organisations interviewed made any attempt at measuring the productivity of their programmers and only 21% of these claimed to have achieved this satisfactorily. Over half the sample simply made no attempt to measure productivity and had no plans to do so.
- o The principal problem of programmer productivity is its measurement. Whilst it is possible to lay down standards

Software Development Manpower Diagram



# EXHIBIT III-3

## THE PROGRAMMING PART OF SOFTWARE DEVELOPMENT PROJECTS

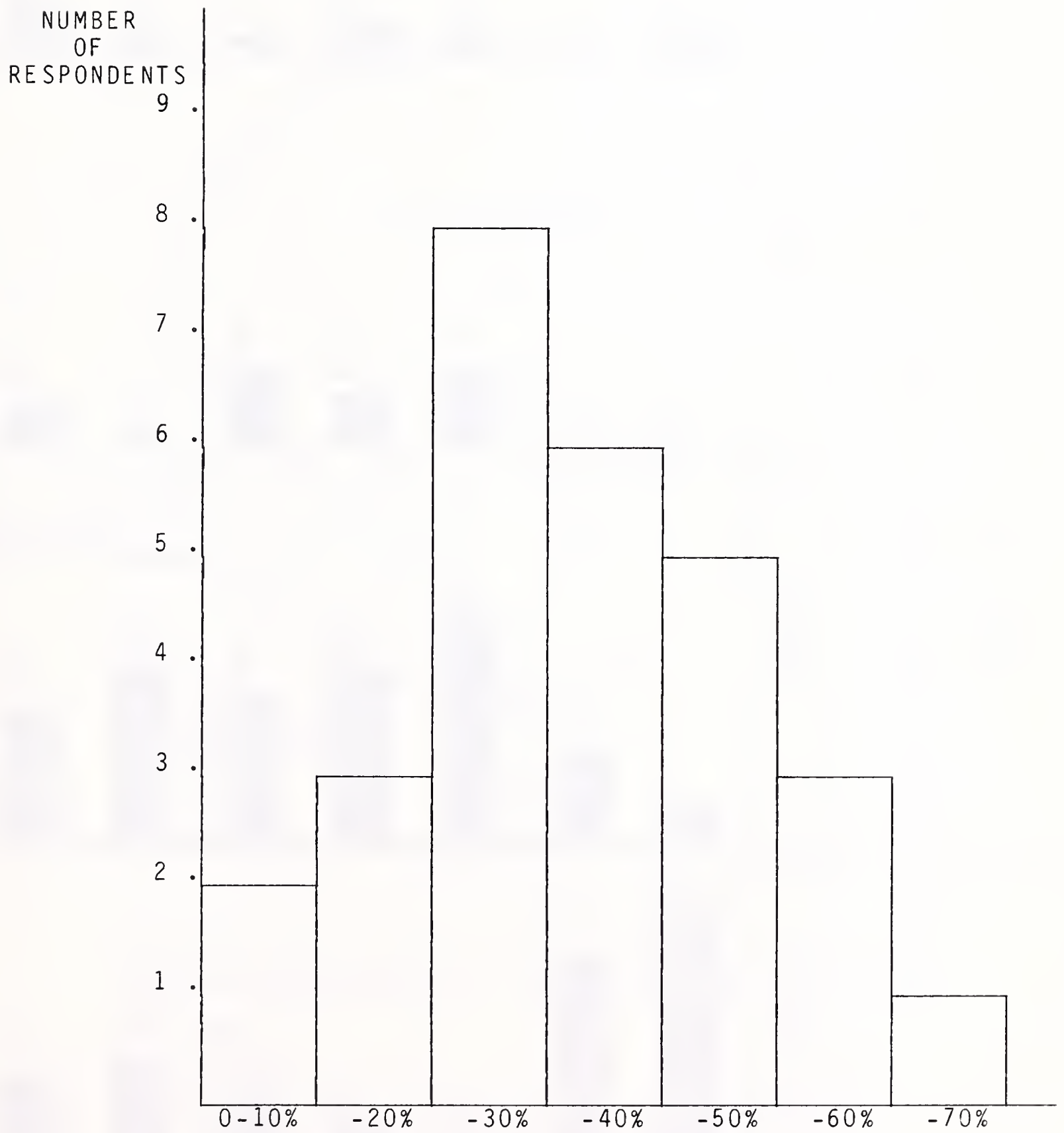


EXHIBIT III-4

ATTITUDES TOWARDS THE MAJOR ELEMENTS OF SOFTWARE DEVELOPMENT

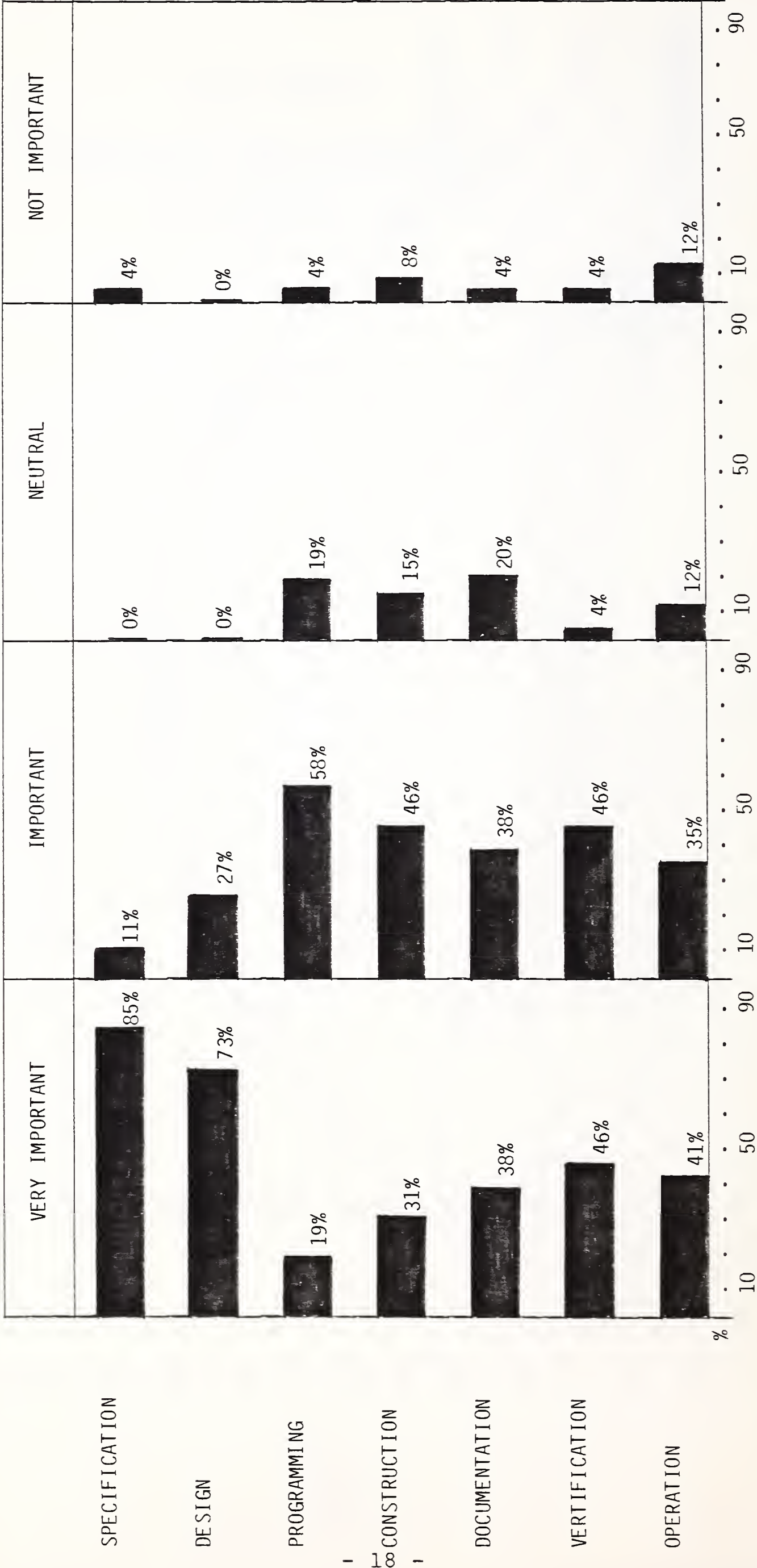
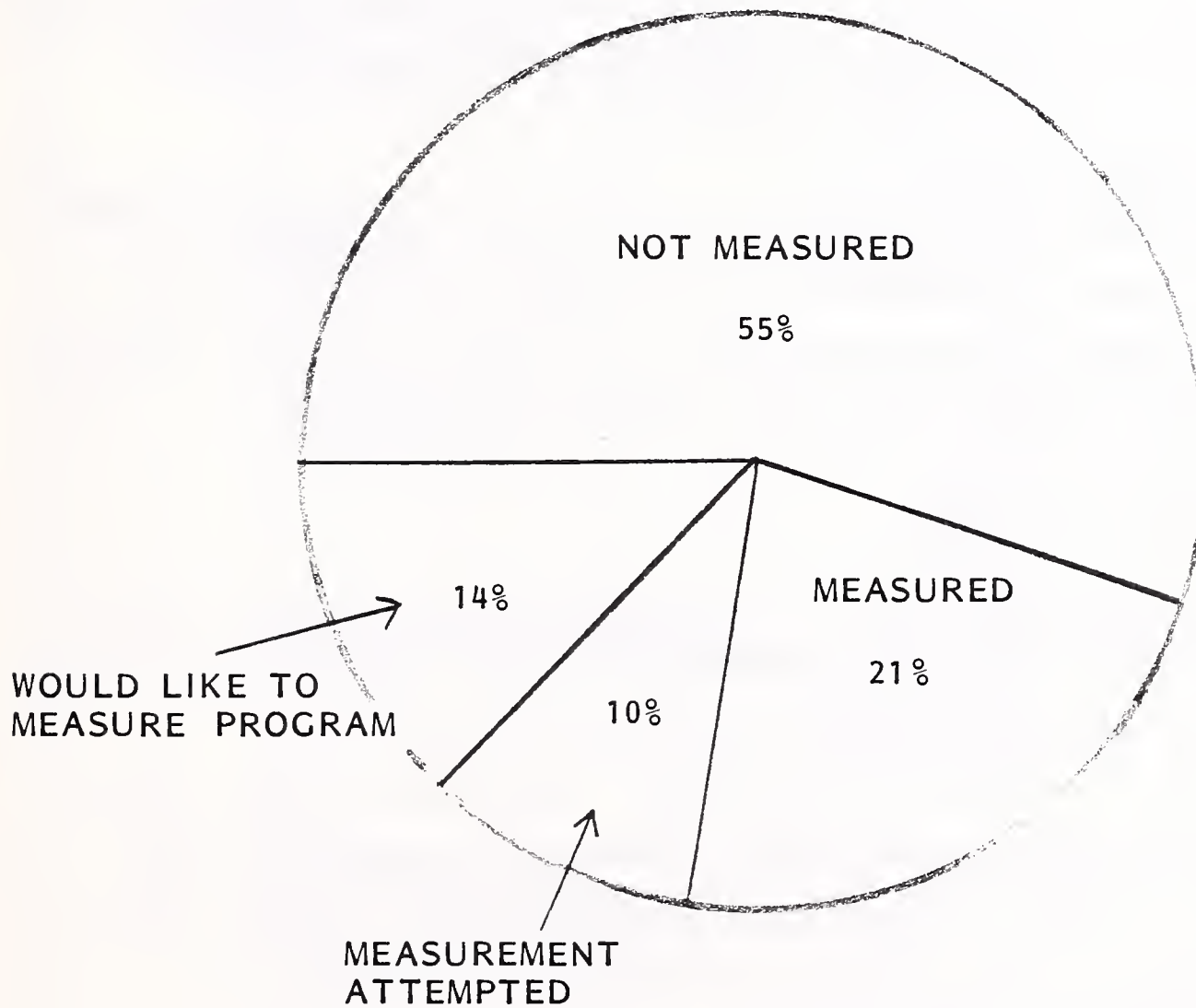


EXHIBIT 111-5

THE MEASUREMENT OF PROGRAMMER PRODUCTIVITY



FACTORS MENTIONED FOR MEASUREMENT OF PROGRAMMER PRODUCTIVITY

- . Average number of lines of code as a function of different types of programming
- . Time-scale
- . Level of staff
- . Quality of software produced
- . Work remaining to be completed on project
- . Maintainability of code
- . Cost



of achievement for commercial applications development, it is seemingly much more intractable to develop such standards for complex software.

- A number of measurement factors were mentioned and these are listed at the bottom of Exhibit III-5. Quality of the software was the most frequently mentioned characteristic. Quality is clearly of overriding importance in most software development situations.
- Programmer productivity is a difficult concept to come to terms with in a quantitative sense in complex software development projects. The evidence derived from the study sample indicates that it is therefore not a highly critical concern for most software developers.

## 2. Productivity Aids

- One of the objectives of the survey was to test out the attitude of software developers to the adoption of a new language to achieve productivity gains.
- The view of software developers seems to be that this would not be an important criteria in language selection. In many instances where software is being developed for a third party the choice of language is determined by the client.
- Where there is a choice, issues like maintainability, reliability and the environment of software tools provided for the programmer were considered to be of greater importance. See the comments made on this issue which are listed in Exhibit III-6.
- Given this situation less than half the respondents were prepared to give a productivity improvement percentage expectation that would justify their adoption of a new language.
- Exhibit III-7 shows the distribution of productivity expectations of those that would consider this as at least some factor in their assessment of languages. We can draw the conclusions that for the software develo-



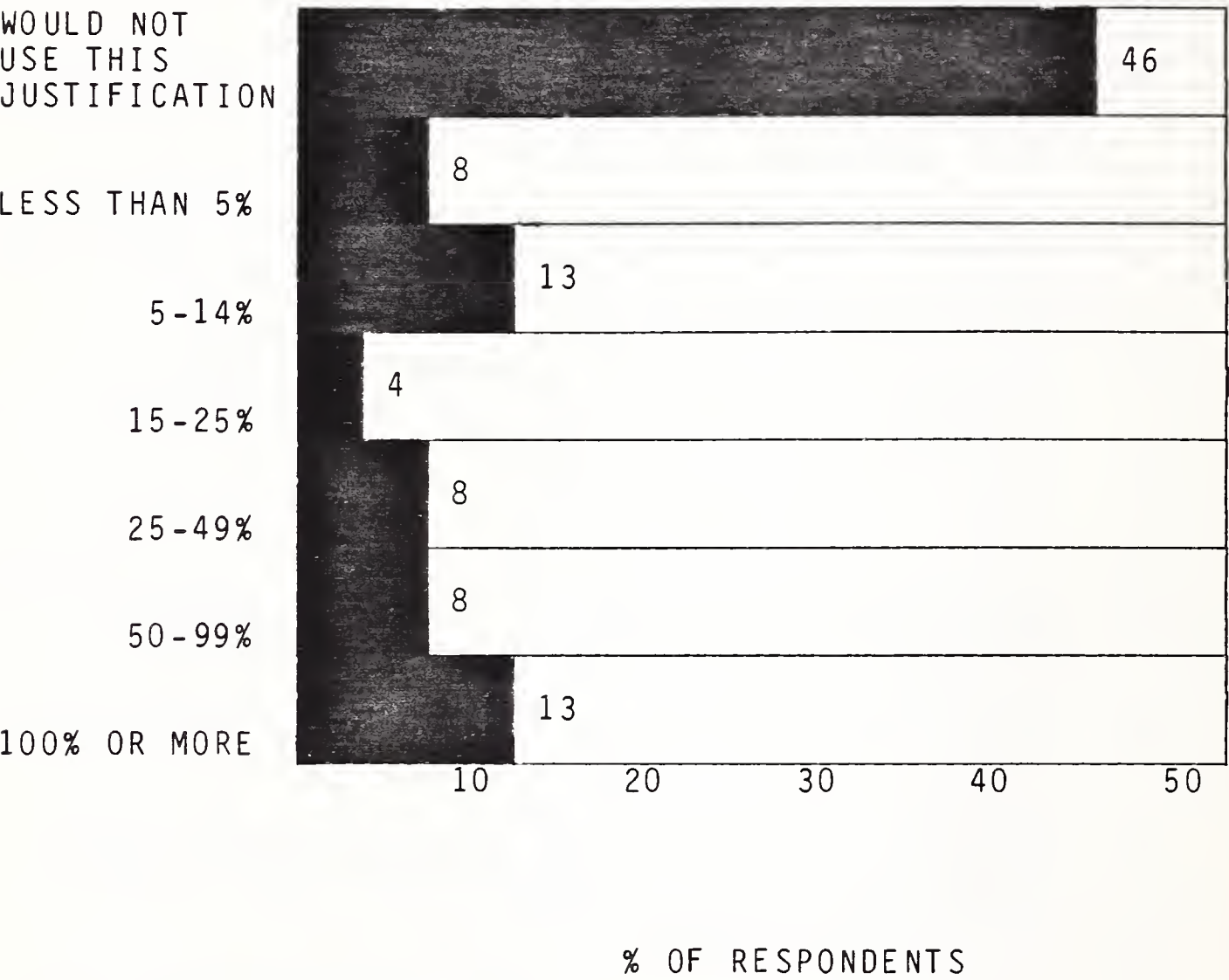
## EXHIBIT III-6

### COMMENTS ON THE USE OF A NEW LANGUAGE FOR DEVELOPMENT PURPOSES

- Choice of language not important from a productivity point of view.
- Would not make recommendation (for a new language) on the basis of programmer productivity - could only be part justified on this basis.
- Would use if language gives other advantages (eg MODULA-2 gives increase in reliability over C and massive increase in maintainability).
- Would be difficult to persuade the company to do this, programming productivity aids have been done to death.
- If proveable; must be shown to be measureable.
- Not a productivity issue it depends on the environment.
- Would use new language if (it) could improve software throughput/development by using new tools.
- Would have to evaluate (a) new language on (a) different basis.
- Measure according to how structured, how easily understood and easily maintained the language is. Prefer ADA standards and O/S.
- Productivity not so relevant as maintainability of software, the software structure and the potential for S/W evolution. Tools for improving specification and design are most important.
- Change of language can only be considered when new more powerful processor can be used.
- Productivity improvement will not be seen in using another language, but in the use of programming tools.

EXHIBIT III-7

PRODUCTIVITY EXPECTATION AS JUSTIFICATION FOR ADOPTION  
OF A NEW LANGUAGE FOR SOFTWARE DEVELOPMENT



pers who are sensitive to this issue only relatively modest improvements in productivity would be needed, but it needs to be born in mind that the other factors already mentioned would be predominant in any decision process.

- The use of development languages and cross-compilers is standard practice within the industry for the development of software on bare-micros and system with limited environments for development purposes. Over 40% of respondents were using development languages of some kind and these are listed in Exhibit III-8.
- For the 25% of the sample who specifically stated that they would not use development languages, reasons related to bad experiences with cross-compilers and concern over future maintainability of the software generated.
- Little evidence of productivity improvements was presented. One respondent claimed a 50% improvement of PASCAL over assembles and another a general 25% improvement from a mix of PASCAL, C and MODULA-2.
- Portability of languages and the flexibility of programmers to move between different projects, quality of the programming environment and quality and maintainability of code were again mentioned as of more importance to language selection than productivity.
- In respect of the question of a stand-alone programmer workstation little evidence emerged to indicate that there was a strong demand for this approach.
- One respondent felt that giving each programmer his own machine was not in the interest of productivity because of the temptation to just play with the software.
- Another respondent claimed that in his experience separate machines for teams of programmers had not delivered productivity improvements. He felt that the disciplines imposed are a far more important factor in this type of situation.

EXHIBIT III-8

USE OF SOFTWARE DEVELOPMENT LANGUAGES  
WITHIN RESPONDENT SAMPLE

<u>LANGUAGE</u>	<u>NUMER OF MENTIONS</u>
PASCAL	8
C	5
MODULA-2	3
ADA	2
CORAL	1
EDISON	1
EUCLID	1
PROLOG	1

- There was however the opinion expressed by another respondent that programmer workstations were definitely the next stage but were just too expensive at the moment. Acceptance of such an approach as the price barriers were lowered would certainly be in line with many other 'radical' developments within the Information Industry.
- In terms of the specific requirements for a new software development environment three major issues stand-out:
  - UNIX
  - Communications Environment
  - Centralised, shared data-base
- Exhibit III-9 shows a complete list of the requirements mentioned by respondents and their frequency of mention.
- UNIX has clearly established a bandwagon effect in the market but it is not universally liked. One user drew attention to its poor performance in Real-Time situations and expressed the view that they were looking for something better.
- The presence of word processing and graphics in the list of users workstation requirements should be noted. As workstation prices fall allowing for their greater use within organisations it will become more and more importance to provide full office type functionality to users. It is unlikely that they will tolerate several special-purpose devices on their desk. Pass-through to other modes of operation will have to be provided.

### 3. MODULA-2

- This section of the report discusses the attitudes to the MODULA-2 language found amongst the respondent group.
- Overall the survey found that MODULA-2 was not a widely used programming language. Very few respondents were actually intending to use MODULA-2 among the market potential respondents. This is shown in Exhibit III-10.



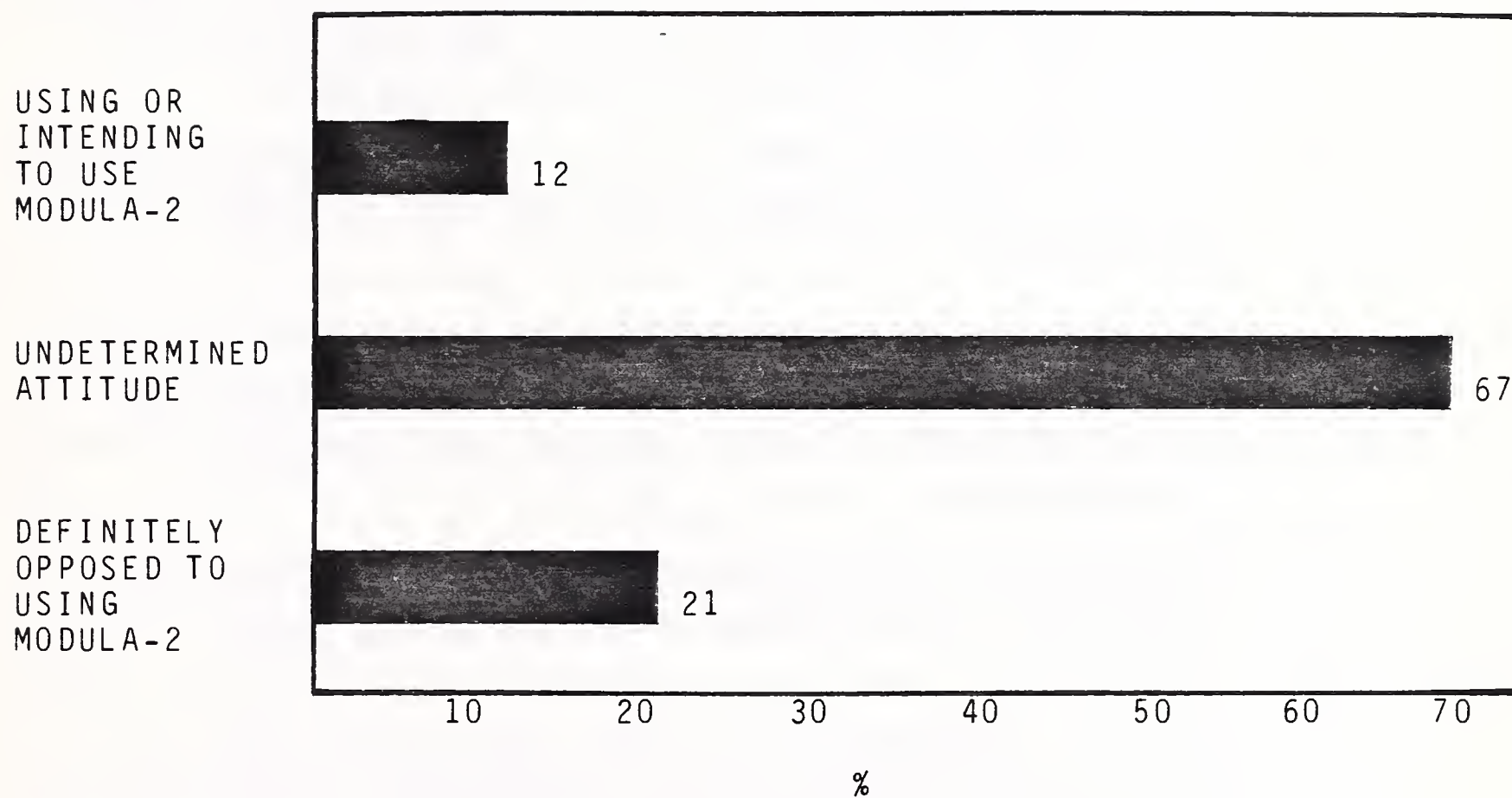
## EXHIBIT III-9

## SOFTWARE DEVELOPMENT ENVIRONMENT REQUIREMENTS

<u>REQUIREMENT</u>	<u>NUMBER OF MENTIONS</u>
UNIX	10
LAN	10
(of which ETHERNET)	(4)
CENTRALISED RESOURCE FOR FILE SHARING	5
OTHER COMMUNICATIONS eg TRANSPAC, SNA, PSS	3
TRANSPORTABLE SOFTWARE PRODUCT	2
PASCAL	1
X-COMPILERS	1
IN CIRCUIT EMULATION	1
SOURCE DEBUGGING ON DEVELOPMENT MACHINE	1
PERIPHERAL SHARING	1
GRAPHICS	1
WORD PROCESSING	1
'C' OR ADA SUPPORT	1
IBM COMPATIBLE	1

EXHIBIT III-10

ATTITUDES TOWARDS USE OF MODULA-2  
AMONGST MARKET POTENTIAL RESPONDENTS





- It can be seen that those who are definitely opposed to using MODULA-2 outnumber those who are already using or intending to use MODULA-2.
- It is however fair to point out that by far the majority of respondents had no determinable attitude. This is largely accounted for by a lack of knowledge of MODULA-2 but at the same time it must be appreciated that many users feel tied to their existing language.
- There did however seem to be a clear distinction between the two groups holding strong positive or negative views on MODULA-2.
- For those software developers concerned primarily with the commercial exploitation of software applications development the attitude towards 'new' languages is one of hostility.
- Indeed it was the reason given when some companies refused to be questioned as part of this survey.
- On the other hand those respondents whose interest had a greater technological content, for example those concerned with complex software development, demonstrated a very open attitude towards the adaption of new languages.
- Clearly it is at this latter group that efforts to promote the use of MODULA-2 must be directed.
- One of the competitive languages to MODULA-2 is of course ADA. The ADA language was prominent in discussion with a number of respondents.
- The great advantage that ADA has over MODULA-2 is of course the enormous bandwagon rolling through the industry on its behalf. It is INPUT's view that, despite growing problems, this bandwagon will continue to roll for sometime, thus limiting the potential for MODULA-2.
- MODULA-2 can obtain a position in commercial markets alongside ADA but it will be virtually impossible to

penetrate the military applications area without a drastic revolution in the current position.

- Further insight into the views of respondents on MODULA-2 can be obtained from the respondent comments listed in Exhibit III-11.
- A further observation on the promotion of MODULA-2 is that attitudes like maintainability rather than productivity may get more acceptance in the market.
- Respondents to the survey were requested to rate programming languages on two particular parameters; relative ease of learning and the relative ease of producing quality software.
- Sufficient respondents were prepared to rate the programming languages of which they had some knowledge to allow for the compilation of a comparative table.
- Exhibit III-12 shows the results of plotting the averaged scores for a number of the more popular and well known languages.
- MODULA-2 scores well on this analysis. It is rated as the easiest (of those languages covered) in which to produce quality software. It scores reasonably well on ease of learning being placed behind BASIC but considerably in advance of ADA.

## EXHIBIT III-11

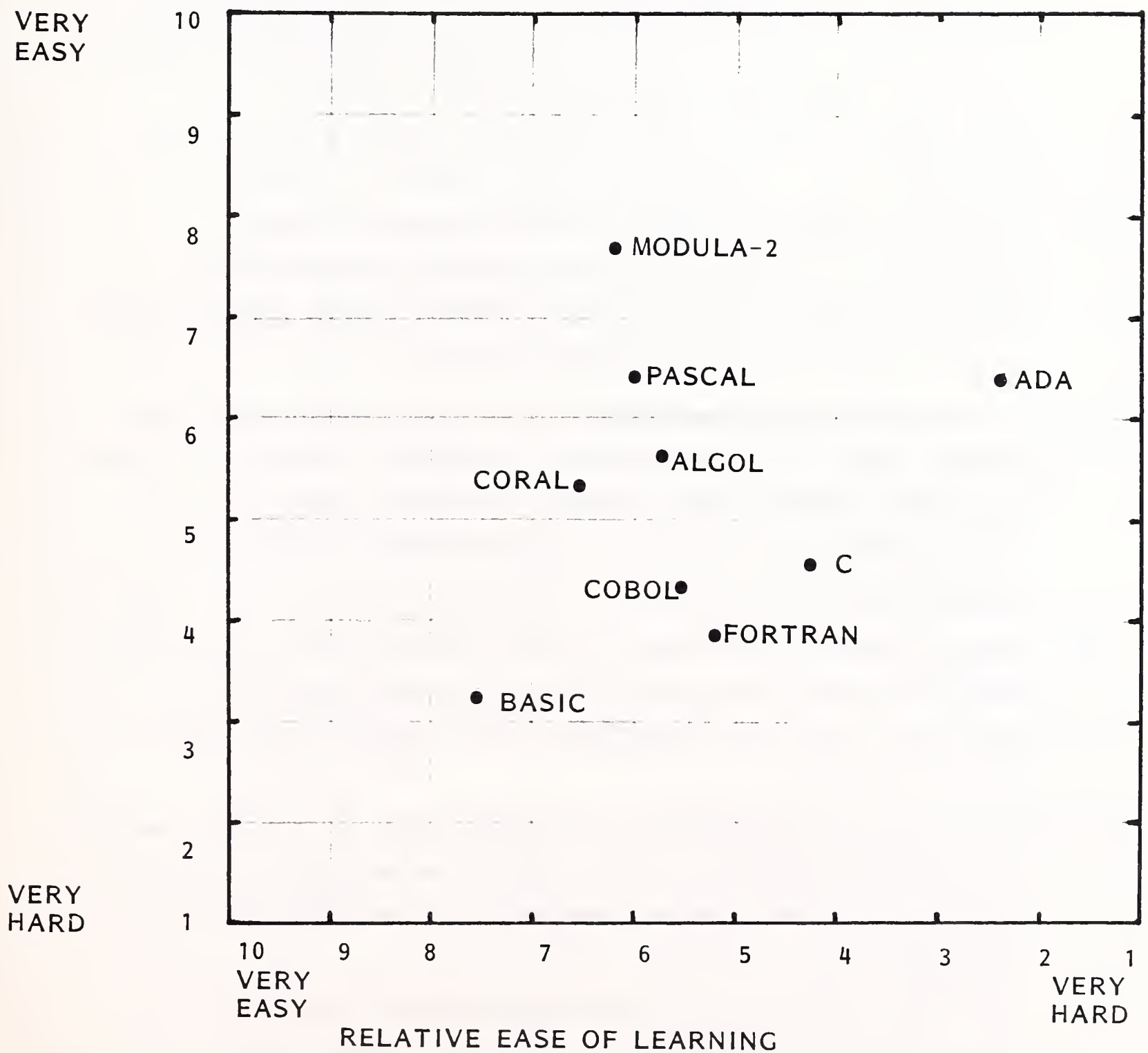
### RESPONDENTS COMMENTS ON MODULA-2

- Languages are not important, only an academic issue. Criteria are Technical, Political, Bandwagon effect and Standards. MODULA-2 fails the test on 3 out of 4.
- Achieving design correctness is the principal factor (in choosing a language). Have chosen MODULA-2 over ADA (for commercial applications) but it was a close run thing.
- MODULA-2 gives an increase in reliability over C and a massive increase in maintainability.
- Would choose C over ADA, PASCAL and MODULA.
- MODULA-2 is planned (for development purposes).
- We chose C over PASCAL even though we anticipated reduced productivity, because PASCAL couldn't do what we needed. We briefly tried MODULA-2.
- Benefits (of using MODULA-2) don't come from the specification phase, but because we are obliged to think more before compiling.
- The MODULA-2 language, library, software tools definitely creates an environment that supports systems development. No question about it!

EXHIBIT III - 12

THE PERCEIVED POSITION OF PROGRAMMING LANGUAGES

RELATIVE EASE OF PRODUCING  
QUALITY SOFTWARE



## B. SPECIALIST MARKET OPPORTUNITIES

- The second major area of the market investigated has been described as Specialist Market Opportunities. This is the area that is most likely to be approached via OEM agreements although this does not necessarily have to be the case. The term OEM is used here to describe any kind of remarketing activity through third parties. As such it includes all possible situations in which the equipment could be marketed by third parties with or without some kind of value-added process.
- In practice the possible outlets for DISER systems must be limited to those areas of the market where its features and capabilities will give it a competitive advantage. The following areas are considered to offer the best marketing opportunities for DISER.

### 1. CAD/CAM

- The market for CAD/CAM or CAE (Computer Aided Engineering) type systems has shown strong growth (around 25% per annum) and is being hotly contested by a considerable number of companies.
- The CAD/CAM market extends to the top-end specialist market for very high-resolution colour graphics devices and other specialist support equipment and software. (For example 4K x 4K pixel resolution screens in systems costing up to half a million dollars and more).
- At the bottom end there is now a considerable quantity of basic CAD/CAM software that is available to run on low cost Personal Computers. (The entry level here is around \$5,000)
- The market opportunity for DISER will be a function of the identification of the appropriate niche in this market. Careful consideration of the following is required:
  - the provision of the appropriate software



- the likelihood of Graphic Software standards such as GKS (Graphics Kernel Standard) and IGES becoming mandatory
  - the ability to meet competitive price levels particularly where OEM distribution is used
  - the rapid development in the market of lower cost high resolution colour displays
- Although this is potentially a very large market precise segmentation of the market and accurate targeting will be of key importance to achieving success. Almost certainly agreements with third-parties will be necessary to ensure the availability of the necessary software and knowledge of the clients graphic processing needs.

## 2. Document Creation

- The Document Creation market again covers a very wide range of needs and requirements. As the top end are photo-typesetting and imaging systems capable of producing very high definition work. At the bottom end are the basic office printing tasks which are covered by the Office Automation market.
- In terms of products this extends again from low cost personal computer based systems to high resolution specialised systems such as the Crosfield Studio 800 costing half a million dollars or more.
- Within this broad market are the rapidly developing sub-markets for business graphics and image-processing. These sub-markets are developing primarily because of the rapidly falling cost threshold for this type of capability.
- Products in this area will meet the needs of business users for processing text, graphics and images for the production of internal reports and other documents. The ability to merge these different forms of data is the vital distinguishing criteria in this market.
- The market is still at a formative stage but it is clear that the DISER system does have attributes which could

be applied in this area.

- The suppliers of office automation equipment are so numerous that accurate targeting of the market is essential in order that users with a high need for these types of capabilities can be identified. Partnerships with office automation vendors could well be the most profitable direction for DISER to take in this area.

### 3. Vertical Markets

- CAD/CAM and Document Creation can be described as horizontal markets in that they can to one extent or another be appropriate to many industry groups.
- It is also important to consider vertical markets, particular industries which may have special needs for the kinds of capabilities that DISER can offer. For example the Insurance Industry has a particular need for document and form preparation and drug companies are making increasing use of graphic processing for molecular analysis.
- The most profitable market opportunities for DISER will be where these horizontal and vertical markets intersect.
- These market opportunities need further analysis and refinement. In all of these specialist markets, seeking OEM partners with specialised knowledge of user requirements and software will considerably reduce the cost of market entry.

### 4. OEM Product Requirements

- The study sample gives some insight into the requirements of OEM's in terms of equipment specification and software requirements.
- Approximately one half of the market potential respondents (13) are active in the OEM area.
- The range of OEM activity covered by the study was wide ranging in terms of market segments, applications and the equipment used as is shown in Exhibit III-13.



# EXHIBIT III-13

## CHARACTERISTICS OF OEM RESPONDENTS

MARKET SEGMENT	NUMBER OF MENTIONS	APPLICATION	NUMBER OF MENTIONS
Manufacturing	4	Decision Support	2
Distribution	2	CAD	2
Banking	2	Energy Managment	1
Government & Military	2	MRP	1
Medical	2	S/W Development Tools	1
Telecommunications	1	Process Control	1
Real Estate	1	Accounting	1
Legal	1	Statistical	1
		Data Base Network	1
		Word Processing/Legal	
		Data Base	1
HARDWARE		LANGUAGE	
DEC VAX	3	PASCAL	4
IBM	3	FORTRAN	3
CONVERGENT TECHNOLOGIES	2	ASSEMBER	3
DEC PDP11	2	APL	2
HEWLETT-PACKARD	1	C	2
TELEVIDEO	1	CORAL 66	1
TI	1	ADA	1
DG	1	CHILL	1
WICAT	1	COBOL	1

- o Exhibit III-14 lists the requirements of OEM vendors for hardware and software features that they would particularly desire in equipment. In many cases no requirements or preferences were stated.
- o The sample of respondents covered a considerable range of activities ranging from IBM PC's to DEC VAX equipment as the basis of value added operations. It is not surprising that a wide range of languages is mentioned.
- o Of interest was the sceptical view taken towards features like the mouse and the window type operating environment. A number of these OEM vendors considered these to be gimmicks and not important features to the end-user.
- o There was also an interest in dot matrix printers in order to offer a low cost printing capability in contrast to laser printers.

### C. MARKET SIZE

- o It is beyond the scope of this study to develop a detailed assessment of the sales potential for DISER systems. However the following data is included to provide an assessment of the likely size of the total market for the areas that DISER could target.
- o The four countries, U.S.A., West Germany, France and U.K. were analysed and together are described as the Total Market for the purposes of this report.
- o INPUT estimates that systems based on the Total Market for Raster Monochrome visual displays for these four countries will be \$700M during 1984. A detailed breakdown is provided in Exhibit III-15.
- o INPUT estimates that currently around 70% of this market is represented by CAD/CAM type equipment and around 20% in business applications.
- o The remaining 10% will be accounted for by other applications such as process control.

## EXHIBIT III-14

## OEM EQUIPMENT FEATURES

FEATURE	NUMBER OF MENTIONS
<u>OPERATING SYSTEM</u>	
UNIX	3
PCDOS	2
VMS	1
<u>LANGUAGE</u>	
PASCAL	3
COBOL	2
C	2
ADA	1
CORAL 66	1
FORTRAN	1
MODULA-2	1
APL	
<u>OPERATING ENVIRONMENT WINDOWS</u>	
IMPORTANT	2
REQUIRED	1
NOT IMPORTANT	3
<u>LOCAL AREA NETWORKS</u>	
ETHERNET	1
PCNET	1
CTNE	1
REL. IMP (#7)	1
<u>GRAPHICS</u>	
COLOUR SCREEN	4
HIGH RESOLUTION	2
CAD CAPABILITY	1

## EXHIBIT III-14 (cont)

## OEM EQUIPMENT FEATURES

FEATURE	NUMBER OF MENTIONS
<u>INPUT DEVICES</u>	
MOUSE	4
MOUSE NOT IMPORTANT	4
TOUCH SENSITIVE SCREEN	1
DIGITIZER	1
<u>OUTPUT DEVICES</u>	
LASER PRINTERS TOO EXPENSIVE	2
DOT MATRIX PRINTERS	2
PLOTTER	1
<u>DISK STORAGE</u>	
CAPACITY IMPORTANT	4

EXHIBIT III-15

ESTIMATED SIZE OF MARKET OPPORTUNITIES FOR DISER

RASTER MONOCHROME BASED DEVICES					\$M
	U.S.A.	WEST GERMANY	FRANCE	U.K.	TOTALS (rounded)
1984 ESTIMATE	554	53	42	51	700
CAD/CAM AND BUSINESS GRAPHICS	500	48	38	46	632
SIZE OF TARGETED SEGMENTS	106	10	8	10	134
1985	132	12.5	10	12.5	167
1986	166	15.6	12.5	15.6	210
1987	207	19.5	15.6	19.5	262
1988	259	24.4	19.5	24.4	328

- Within the overall market it is assumed that DISER will only market to selected high-opportunity segments. These are defined as follows:
  - Within the CAD/CAM Market the Printed Circuit Board and Mapping categories. (20% of the market)
  - Within the Document Creation Market it is assumed that DISER could target 25% of the market.
- The application of these assumptions gives a total estimate of the available market for DISER of \$134M during 1984 and this is shown in Exhibit III-15.
- If we make the further assumption that DISER can obtain between 10% and 20% of its selected target markets then we can derive a forecast range of potential sales of DISER equipment to \$13M and \$27M for 1984. This excludes the sales value of Laser Printers sold as part of DISER systems.
- INPUT estimates that these markets are growing at around 25% per annum, and an extrapolation of the potential market sizes using this rate is shown in Exhibit III-15.
- On the above basis sales of DISER equipment could potentially be between \$33M and \$66M by 1988.
- These estimates are of necessity tentative and require further refinement, cross-checking, and evaluation. In no way should they be considered as a realistic sales forecast (highly dependent on numerous other factors like the channels of distribution available) but simply as a measure of the market opportunity available.

#### IV. USER EXPERIENCE OF DISER





## IV USER EXPERIENCE OF DISER SYSTEMS

- Since the DISER system is relatively new onto the market little experience exists of an in-depth nature on the use of the equipment. The users interviewed had only limited exposure to the DISER system, in some cases for only a few weeks.
- The relatively small number of user interviews however, provides the opportunity of giving an insight into the views of users by means of a narrative description of each organisation's experiences with the DISER equipment and these can be found in sections B through G of this chapter.
- Section A provides an analysis of the major findings from users concerning the strengths and weaknesses of the DISER equipment from their point of view.

### A. STRENGTHS AND WEAKNESSES

- The strengths of the DISER system were seen by users to be primarily its provision of a good MODULA-2 environment, and its graphics, windows and printing capability.
- Exhibit IV-1 lists features mentioned by users as being of most value to them.
- Exhibit IV-2 lists those features which users considered as deficiencies in the DISER system.
- It can be seen that no particular feature really stands out. Nevertheless there is a fairly comprehensive list of points which will require further consideration by DISER.
- The overall impression was that the DISER systems strengths were highly dependent on its MODULA-2 capability.

# EXHIBIT IV-1

## MOST VALUABLE EQUIPMENT FEATURES

FEATURE	NUMBER OF MENTIONS
Good MODULA-2 environment	3
Printing & Documentation capability	2
Graphics capability	2
Window feature	2
Good VDU	1
Fully addressable screen	1
Single-user workstation	1
Fast compilation	1
Good editor	1
Cross compilation capability	1
Degree of power for the price	1

# EXHIBIT IV-2

## USERS PERCEIVED DEFICIENCIES OF DISER SYSTEM

FEATURE	NUMBER OF MENTIONS
FORTRAN	2
Memory too small	2
PASCAL	1
UNIX and C	1
Sharing centralised files	1
MODULA-2 S/W development tools	1
No communication with other machines	1
Computer code too hidden from user cross compilation	1
Interrupt handling	1
Peripheral interface capability	1
Networking capability	1
Copying disks	1
Text processing not comprehensive enough	1
No colour screen	1
Editor not powerful enough	1

## B. CERN

- Two people were interviewed at CERN in respect of their experience of the DISER equipment which was relatively limited since it was not installed until December 1983.
- Dr Palazzi is responsible for running a series of informal tutorials on MODULA-2 based on the DISER equipment.
- Dr van der Stock uses the DISER system as a development tool for writing real-time control systems in MODULA-2 for a target Motorola 68000.
- CERN have a variety of equipment installed that is broadly competitive with DISER. This equipment includes the following workstations:
  - 2 PERQ
  - 3 APOLLO
  - 1 HP9000 (on loan)
  - 2 DISER
- Out of these systems the APPOLLO is most favoured (it is fair to point out that the application users have not experienced the DISER system because of its lack of FORTRAN). The PERQ seemed to be least liked and has had few applications developed for it.
- CERN are looking towards workstations as the way forward for program development, particularly where they themselves can be the software developers so that they can tailor it to their own particular requirements. An example of this is for use as a laboratory control workstation.
- However at this point in time they haven't yet established any guidelines for the procurement of personal workstations. They feel that the market has not yet stabilised and they are prepared to bide their time until it becomes more ordered.
- At the moment CERN's use of MODULAR-2 is fairly tentative. The heavy FORTRAIN bias in the past limits the use of MODULA-2 to new applications.

- A major area of CERN's applications is for data reduction and evaluation of data from experiments. They still have a strong need for FORTRAN which would clearly strengthen the capabilities of the DISER system if it were available. They are currently investigating the impact of using a new language for this kind of work, but it is obviously too early to comment on MODULA-2's performance in this area.
- CERN see the strong point of the DISER system as its single user configuration. They also commented favourably on its graphics and printing capabilities. Inability to transfer files to the computer centre and the lack of software development tools available with MODULA-2 were weak points.
- For CERN another weakness of the DISER system was concerned with cross compilation to the target microprocessor. They felt that the compiler code structure was far too hidden from the user.
- Other concerns related to the need to meet overall requirements for operating system and networking standards and the omission of a FORTRAN compiler and thus the inability to use their existing libraries of FORTRAN programmes.
- Overall CERN felt that MODULA-2 has created a lot of interest within the organisation but that the DISER equipment itself was not particularly unique and is considered expensive.

### C. CNAM

- CNAM is an educational establishment which provides day and evening classes in programming primarily on DEC equipment. Mr Dewez was interviewed.
- This interview provided some insight into the use of MODULA-2 on the DISER system in an educational institution.



- The reaction of this organisation to MODULA-2 was positive. They felt that it was a much more productive language for use in teaching programming, advantages including:
  - separate compilation
  - direct archive access
  - optimum use of resources
- They also feel that the portability of software has been substantially improved through the use of MODULA-2.
- Another attractive feature of MODULA-2 is its superiority in facilitating a more abstract approach to problems. This they think will make it more appropriate for the more advanced leading edge type of user.
- CNAM perceive, however, a need for a language to be used in the specification of projects that would interface to MODULA-2 in some way. CNAM are clearly influenced in their view point on this area by their use of IBM's META IV project specification language.
- In terms of the DISER system itself they rated the visual display and windowing capability highly and emphasised that the resulting man/machine interface was very satisfactory.
- They also commented on the fast compilation speeds of the DISER system in comparison with their PDP-11.
- Deficiencies related to the current limitations on memory, 2M bytes being considered necessary in order to make full use of the windowing capability.
- Other problems mentioned related to the management of interrupt processing and the capability to interface more devices to the system.

#### D. EUROCONTROL

- The interview with this research and development organisation was with Mr Krella. They were primarily con-



cerned with Radar applications for air traffic control but also had interests in other applications like voice recognition, simulation and general purpose software development.

- A variety of equipment is used by EUROCONTROL including DATA GENERAL ECLIPSE, BULL, PHILIPS AND GOULD as well as DISER and IBM and Siemens mainframes.
- To date little software development has been done on the DISER equipment but it is planned to be used for the production of software for a PDP11 which is the target machine for a new software contract.
- Other aims in using the DISER equipment are:
  - production of extra operating facilities for minis and mainframe computers
  - use in simulating aspects of air-traffic control in the expectation that the DISER system will prove to be a flexible tool.
- DISER equipment was chosen in preference to the XEROX Star because of the latter's office orientation.
- As far as MODULA-2 was concerned their comments were limited, primarily because of their lack of experience with the language.
- They perceive it to be a suitable tool for a software engineer to use at a workstation but expressed some doubt about the calibre of staff needed to use it effectively. They saw MODULA-2 as an easy transition from Pascal but dependent on the programmers willingness to change to a new language. They were not yet in a position to rate MODULA-2's capability for producing quality software.
- Strong points of the DISER system were seen as:
  - providing a good environment for MODULA-2
  - good editor
  - its linkage capability to the PDP-11
  - its capabilities for the production of documentation

- For their experimental uses the following DISER features were mentioned as being particularly attractive:
  - the fully addressable screen
  - the 'window' feature
  - the interactive graphics
- Deficiencies related to the following areas:
  - lack of local area network
  - problems in copying disks (one disk station for the cartridge)
  - the compiler editor and text processing capability are different and less powerful than the features they are used to on the mainframe. They are more complex to use.
  - the lack of colour screen limits its attractiveness to commercial markets.
- They also felt that the DISER system would be more effective and have greater market potential if it could also be used as an intelligent terminal linked to a mainframe or other host computer.

#### E. SULZER

- Mr Pianta was interviewed on behalf of Sulzer who have recently taken delivery of a DISER system for a stand-alone application at the group headquarters in Winterthur. The application concerns security aspects of nuclear technology.
- The initial application for the DISER system is connected with wordprocessing encompassing:
  - the preparation of form masks
  - data capture and processing
  - printing of results using different styles and graphics.

- It is planned to develop further applications in the area of data base processing using NIDAS:
  - storage and preparation of statistics
  - a personnel data base.
- Although experience of the DISER system and MODULA-2 is limited SULZER rates the quality of programs produced extremely highly and considers that a program development improvement in excess of 25% has been achieved.
- SULZER will be using the DISER system for routine processing as well as for program development.
- Advantages of MODULA-2 were perceived to be:
  - its very powerful commands
  - low memory requirements
  - ease of learning.
- Deficiencies of the DISER system mentioned were:
  - lack of a Fortran compiler to make use of existing Fortran libraries
  - lack of PASCAL capability
  - lack of C and UNIX operating system.

#### F.    SIGNETICS

- SIGNETICS probably represents the most enthusiastic example of a commercial user of DISER equipment. Dr Robert Burton was interviewed.
- It is a case that has become particularly well known to the DISER Corporation because of its geographic proximity to their headquarters and because of the commercial agreement between the two companies. In this agreement DISER equipment has been exchanged for the rights to market SIGNETICS developed software.
- This software is for Computer Aided Design (CAD) of electronic circuits and boards, which has given DISER an

entrée to a particular sub-segment of the CAD/CAM market, and this is therefore ripe for further exploitation.

- SIGNETICS has clearly been attracted to the use of DISER equipment through the use of MODULA-2 for lengthy complex programming tasks.
- They consider that MODULA-2 provides the capability of writing the most readable programs that any language can produce.
- They are an organisation which claims to have measured programmer productivity and in their view the use of MODULA-2 has increased productivity in excess of 100%.
- In terms of dollar savings SIGNETICS claim that the impact of this productivity improvement on their organisation is worth \$15K per month or \$180K per year.
- Further they would rate the quality of programs produced by MODULA-2 as of the highest quality.
- As far as the DISER system itself is concerned SIGNETICS see its most valuable aspect as the degree of power which is provided for the price.
- The only deficiency which they mentioned was its lack of memory, memory expansion would be an important feature for them.

#### G. UNIVERSITY OF COLORADO

- The University of Colorado is an example of a potential enthusiastic user of DISER equipment in a joint educational, software development situation. Dr Richard Weiner in the Department of Computer Sciences was interviewed.
- At the moment the University of Colorado use a SAGE development machine for the production of Statistical software for IBM Personal Computers. MODULA-2 is the development language used.

- They are enthusiastic users of MODULA-2 and believe that the language, library and software tools definitely create an environment that supports systems development.
- They currently do not actually use the DISER system as it is unable to communicate with the rest of the computer world. They have a strong need to be able to create software which can be readily transported to other computers.
- They stated that once this drawback had been overcome they would definitely use some DISER systems.
- The University of Colorado had experienced a considerable increase in programmer productivity, using MODULA-2 which had been measured on the basis of the number of days taken to write a module. Programs having been partitioned into modules at the design stage.
- Dr Weiner stated that they had actually doubled their productivity, and considered that the use of MODULA-2 resulted in very high quality programs.
- Dr Weiner also commented that they had been impressed with the goals of the DISER Corporation.





## V. COMPETITIVE ANALYSIS



## V. COMPETITIVE ANALYSIS

- The number of suppliers of microprocessor based workstations, personal computers and similar products is in excess of 200 and at this point in time still growing.
- In order to clarify the competitive position for DISER systems it is necessary to concentrate on those areas of the market in which DISER aims to position its product. These have been classified as:
  - Programmer Productivity Products
  - CAD/CAM Systems
  - Document Creation

### A. PROGRAMMER PRODUCTIVITY PRODUCTS

- Individual programmer workstations and program development systems are a relatively untried concept in the market. There is however a considerable market for programmer development software tools and aids.
- As already described in Chapter III there is little evidence from this study of a general acceptance of a language as a productivity aid in itself.
- In order to assess the competitive position of the DISER product in the market three products are described below which indicate the kinds of products that are now emerging onto the market in this area.
- That is the market for software development aids, high level software development for bare-micro, embedded and other high level software developments. The general commercial software-development market is not considered.
- These three products are:
  - System Designers Limited's PERSPECTIVE

- SCS's PRADOS System
- The CODATA system 3300

## 1. PERSPECTIVE

- PERSPECTIVE is an integrated set of tools running on the VAX11 range of computers which helps software development teams design, program and test systems more efficiently.
- It was developed by and is available from Systems Designers Ltd.
- It is a combination of a design approach, programming environment and a management information system.
- It is designed to provide software development facilities for modern microcomputers, complex real-time, communications and control systems and large development projects.
- The programming language environment is PASCAL with PALE - Pascal Language Extensions. These extensions include modularity and the separation of an interface between two components from its actual implementation. This can be considered as a parallel development to MODULA-2.
- System Designers claim some advantages over the MODULA-2 approach based around taking the 'system building' rather than the 'language approach'.
- System Designers feel that their product is fairly unique in the market at the present time but mentioned SCCS and PASSPORT by Softech as possible contenders at a lower level of sophistication.
- PERSPECTIVE is sold as a software only system as a set of modules. Typical pricing is:
  - For host software on VAX11/780 \$22,700.
  - For target module \$8,500 - 11,200.
- Further information on PERSPECTIVE is provided in Appendix B Section A.

## 2. PRADOS

- SCS (The German subsidiary of SCICON International) has developed in cooperation with Triumph-Adler a program development system called PRADOS. It is aimed at providing a more efficient programming and test environment.
- PRADOS runs under UNIX and uses the C language, although plans exist to incorporate facilities for PASCAL and FORTRAN.
- The software system is implemented to run on either PLEXUS or DEC VAX equipment. SCS will supply the system complete or simply as a software system for running on the users existing hardware.
- An average system configuration for PRADOS is considered to consist of a PLEXUS System 25, with 40MB hard disk and 4 CRT's which sells for around \$44,000. The PRADOS software costs around \$20,000.
- Further information on PRADOS is provided in Appendix B Section B.

## 3. CODATA SYSTEM 3300

- CODATA is an American based company that manufactures a 16 bit 68000 multi-user system, the CODATA System 3300, operating under UNIX, aimed primarily at the OEM market.
- In the UK it is being marketed by Cambridge Micro Computers Ltd who have positioned it primarily as a programmer productivity tool for cross-compilation to bare micros.
- This market positioning is clearly demonstrated in their advertising, an example of which is shown in Appendix B Section C.
- With one programmer workstation (eg VT101 compatible), 265Kb memory, 10Mb Fixed Winchester, 1Mb diskette, 2 serial ports a CODATA 3300 including software sells for under \$14,000.
- Graphics capability can be obtained through the addition of an Heurikon graphics board and they are planning to

add a 1,000 x 1,000 pixel Mitsubishi graphics screen.

- Their marketing approach has been primarily towards Universities and Research laboratories and they are anticipating current sales levels at around 40 per annum for the U.K. market.

## B. CAD/CAM SYSTEMS

- The CAD/CAM market, as already commented on in Chapter III Section B.1, is very wide ranging and is being targeted by large numbers of suppliers.
- A key feature of the market is the degree to which OEM arrangements are used by suppliers to meet specialist needs.
- Systems available for general purpose CAD/CAM are channelled through other suppliers who add value with special software to meet the particular needs of users within narrowly defined market segments.
- For example MENTOR Graphics targets the aerospace, semiconductor and computer manufacturer sub-markets with a system based on an Apollo 32 bit Domain processor called the Idea logic design and analysis system.
- This OEM type activity can make it difficult to carry out a fair comparison based on published prices and brief technical specifications.
- Higher prices usually indicate the availability of specialised or more sophisticated software.
- Section D of Appendix B lists examples of equipment which are broadly considered to be competitive to the DISER system.

## C. DOCUMENT CREATION SYSTEMS

- The Document Creation market, has been briefly described in Chapter III Section B.2.



- The term Document Creation is used to cover all types of applications which require good quality printing capability.
- One particular area of this market that is now receiving considerable attention is that for Business Graphics.
- Increasing availability of graphic and text manipulation capabilities, for example low cost personal computers, are creating a market for graphic processing and quality printing capability.
- This represents an extension of the so called Office Automation market. Only recently this type of complex graphics and text merging and high quality printing capability were the province of very expensive laser printer installations.
- The advent of lower cost laser printers and more powerful computer workstations, like the DISER system, are bringing this capability into the office.
- Potentially these applications could be provided by some of the equipment listed in Section D of Appendix B. This list therefore serves as one element in a competitive analysis.
- A further level of analysis would need to examine software capabilities, laser printer interface capabilities and the quality of printed output. These tasks are beyond the scope of this study.



## VI. CONCLUSIONS AND RECOMMENDATIONS



## VI CONCLUSIONS AND RECOMMENDATIONS

### A. CONCLUSIONS

- This market assessment set out to assess the potential markets for DISER as:
  - a programmer productivity workstation
  - as a basis for OEM sales in specialist markets like CAD/CAM and Graphics.
- 1. No Market For Programmer Productivity Workstations
- INPUT have concluded that there is not a market for the DISER System as a Programmer Productivity workstation except within the university and research environments where MODULA-2 has gained acceptance.
- Programmer Productivity is not a key issue within the identified specialist software development field. The reasons for this are:
  - Overall Project Productivity is of more importance, particularly the Specification and Design stages.
  - Programmer Productivity is difficult to define and measure.
  - It is not significant in situations where the software development costs can be amortised over many units as in embedded systems.
  - Programming development environments are of much greater importance than the particular chosen language.
  - Choice of programming language is determined by criteria other than ease of development eg. maintainability, operational performance and is sometimes specified by the client and therefore no choice is available.

## 2. Potential Specialist Markets Need Careful Selection

- INPUT have concluded that there are opportunities for DISER in specialised markets like CAD/CAM and Document Creation. There are however certain conditions that must be met for these opportunities to be developed:
  - these markets must be tackled via business partnerships or OEM agreements of some kind
  - competitive OEM pricing and discount structures must be made available.
  - other languages than MODULA-2 may have to be provided.
- Therefore these potential markets need careful selection. The market is very crowded, there are various bandwagons eg. UNIX and 68000 microprocessors that heavily influence OEM's.
- DISER has strengths in graphic and text manipulation which have potential for CAD/CAM and the developing Document Creation markets.
- Selection of the market niche is critical. Both horizontal and vertical markets must be examined for intersection. These areas will offer the best potential.

## 3. MODULA-2; Strength And Weakness

- MODULA-2 is both potentially a strength and weakness for the DISER Corporation.
- On the one hand MODULA-2 gives the DISER system its uniqueness, differentiating it from other similar products on the market. In the face of a rapidly developing acceptance of MODULA-2 DISER systems would be well placed to attract sales of their product as a MODULA-2 workstation.
- On the other hand MODULA-2 represents a weakness in that users will typically demand other languages and environments which specifically exclude the DISER system from consideration.



- There is evidence of a growing interest in MODULA-2 in the marketplace but it is still a relative minority interest.
- INPUT concludes that there exists a relatively small market for the DISER system as a MODULA-2 programmer workstation in Universities and Research and Development laboratories where MODULA-2 is used.
- This market could be expanded in unit volume by offering lower cost equipment and technical enhancements principally Local Area Networks, shared file resources and the UNIX environment.

## B. RECOMMENDATIONS

### 1. Hardware Manufacturer Or Software Supplier

- INPUT strongly recommends that DISER give very careful consideration to their strategic direction. Is DISER:
  - primarily a centre of software experience and expertise (based on MODULA-2) which can be leveraged in the marketplace?
  - or a manufacturer/system builder that can offer uniqueness or market leadership in terms of manufacturing costs, technical specification or distribution and service?
- INPUT believes that DISER's strengths lie in the first of these two areas and recommends that DISER build a business strategy that capitalises on this.

### 2. Selection Of Business Goals

- DISER must develop a set of business goals commensurate with its resources and capabilities that are consistent with its overall strategic direction. Some suggestions are described briefly below.

#### a) Software House Capability

- Develop a software house capability that would leverage the expertise and experience that DISER has of MODULA-2. This activity does not have to be entirely dependent on the MODULA-2 market alone because cross-compilation techniques can be used and because programming expertise is relatively easily transported between languages.
- Possible activities could cover:
  - development of MODULA-2 compilers for other target systems
  - contract software development for embedded systems or bare micros
  - development of sophisticated software development environments for specific target systems.

b) MODULA-2 Programmer Workstation

- Continue to target the Universities and Research and Development organisations with DISER systems to exploit MODULA-2 uniqueness feature.
- Enhance the system with capabilities devised from following goal (a) above. For example, developing a MODULA-2 development environment and tools. Developing a UNIX environment and capability in other languages. For example a capability in C and PASCAL would allow a "Trojan Horse" type approach to be adopted.

c) Specialist Markets

- This would be, as already described above, the selection of specific markets where DISER systems show particular or significant advantages.
- Examples of certain CAD/CAM and Document Creation markets have already been quoted.

3. Select Partners

- INPUT believes that wise selection of partners is one of the key strategies that can drastically increase the

probability of survival and success. The market is becoming rapidly saturated with suppliers and will before long experience a drastic shakeout.

- Sound businesses, clearly focussed and offering clear advantages and capabilities are required to surmount the product and market confusion that currently exists.
- Within the overall strategic direction outlined above DISER should seek business relationships that are consistent with its medium and long term business goals.
- Finding such partners will dramatically increase the soundness of the DISER Business Plan. Not only do such arrangements provide access to vitally needed software but provide the detailed knowledge of customer's needs and requirements. These will be essential to lowering the cost of entry to the potential markets described in this report.



APPENDIX A.





## APPENDIX A: FINANCIAL AND COMMERCIAL COMPANY DATA

- The purpose of this appendix is to provide comparative data that can be used in an overall assessment of the valuation of the DISER Corporation. No attempt is made here to do anything other than provide data upon which such an evaluation could be conducted.
- This appendix provides general commercial and financial data on companies that are considered relevant for the purposes of meeting this objective.
- Exhibit A-1 provides an index to the information contained in this appendix.



## EXHIBIT A-1

### LIST OF COMPARATIVE COMPANY FINANCIAL AND COMMERCIAL DATA

- A. AUTO-TROL TECHNOLOGY CORPORATION (Annual Revenue \$44M)  
Selected pages from a Prospectus for a share issue dated October 26th 1983.
- B. INFORMATION DISPLAYS INC. (Annual Revenue \$12M)  
Financial Highlights from the Annual Report for Fiscal Year ending 31.12.82. (re-typed as printed in revenue type in original)  
  
Consolidated Balance Sheets:  
  
- Assets  
- Liabilities and Stockholders Equity  
  
Consolidated Statements of Operations  
Consolidated Statements of Stockholders Equity  
Consolidated Statements of Changes in Financial Position
- C. CONVERGENT TECHNOLOGIES (Annual Revenue \$96M)  
Selected pages from Annual Report.
- D. CAWDOR (Annual Revenue \$5.6M)  
  
Financial and Commercial Summary of this U.K. based holding company which recently raised venture capital to increase its R & D and expand its dealer network.
- E. TELEMETRIX (Annual Revenue \$8M)  
  
Significant European supplier of CAD/CAM workstations, details of annual financial performance and successful stock exchange listing offer.
- F. HYTEC (Annual Revenue \$3.8M)  
  
Small manufacturer of microsystems using venture capital to fund development of a 32 bit system.

EXHIBIT A-1 continued

G. BLEASDALE COMPUTERS (Annual revenue \$1M-2.8M)

Details of capital raising exercise for this manufacturer of a UNIX based 68000 system primarily sold to academic market, now seeking to extend into wider commercial market.

H. MICROMITE (Annual revenues \$140,000 +)

Details of capital raising exercise for this 18 month old start-up company manufacturing a microprocessor based fileservet.

**A.**

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*P R O S P E C T U S*

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**Auto-trol®**

650,000 Shares

**Auto-trol Technology Corporation**

**Common Stock**

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*The Company's Common Stock is traded on the NASDAQ National Market System. The closing sale price for the Common Stock as reported by NASDAQ on October 26, 1983 was \$17.00 per share.*

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THESE SECURITIES HAVE NOT BEEN APPROVED OR DISAPPROVED BY THE SECURITIES AND EXCHANGE COMMISSION NOR HAS THE COMMISSION PASSED UPON THE ACCURACY OR ADEQUACY OF THIS PROSPECTUS. ANY REPRESENTATION TO THE CONTRARY IS A CRIMINAL OFFENSE.

	<i>Price to Public</i>	<i>Underwriting Discounts and Commissions</i>	<i>Proceeds to Company(1)</i>
<i>Per Share</i>	<i>\$17.00</i>	<i>\$.95</i>	<i>\$16.05</i>
<i>Total(2)</i>	<i>\$11,050,000</i>	<i>\$617,500</i>	<i>\$10,432,500</i>

(1) *Before deducting expenses payable by the Company estimated at \$170,000.*

(2) *The Company has granted the several Underwriters an option, exercisable for 15 days from the date of the initial public offering of the Common Stock offered hereby, to purchase a maximum of 97,500 additional shares in order to cover over-allotments of shares. If the option is exercised in full, the total price to the public shown above will be increased to \$12,707,500, total underwriting discounts and commissions to \$710,125 and total proceeds to the Company to \$11,997,375.*

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*The shares are being offered by the several Underwriters when, as and if issued by the Company and delivered to and accepted by the Underwriters and subject to their right to reject orders in whole or in part. It is expected that the shares will be ready for delivery on or about November 3, 1983.*

**The First Boston Corporation**

**Hambrecht & Quist**  
Incorporated

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*The date of this Prospectus is October 26, 1983*



## PROSPECTUS SUMMARY

The following summary is qualified in its entirety by the more detailed information and consolidated financial statements appearing elsewhere or incorporated by reference in this Prospectus.

### The Company

Auto-trol has been engaged since 1973 in the development, manufacturing, marketing and servicing of computer-aided design and drafting and computer-aided manufacturing ("CAD/CAM") systems. Over the past two and one-half years, Auto-trol has developed a new product line incorporating features which the Company believes reflect the emerging technologies and systems approaches in the CAD/CAM industry. These features include distributed processing and local-area network communications, 32-bit virtual memory computers, open system architecture, standardized computers and operating systems and high-performance raster displays. Auto-trol believes that it is the first vendor to offer a turnkey, distributed processing, networked CAD/CAM system to the architectural, engineering and construction ("AEC") market and the mechanical design market.

The Company's distributed processing, networked system is based on its Advanced Graphics Workstation (the "AGW"), which utilizes 32-bit computers manufactured by Apollo Computer Inc. The AGW was first introduced in mid-1982 with the Company's mechanical design software and became available in the second quarter of 1983 with the Company's AEC software. Auto-trol also offers a system based on the 32-bit VAX computers manufactured by Digital Equipment Corporation. This system was introduced for the mechanical design market in 1981 and has been recently expanded to include AEC software and Auto-trol's Advanced Raster Workstation (the "ARW"). Both AGW and VAX-based systems now support Auto-trol Series 5000 software for the AEC market and Auto-trol Series 7000 software for the mechanical design market. Auto-trol's customers include petroleum and chemical companies, architectural and engineering firms, construction contractors, retail merchandisers, public utilities, and manufacturers of a wide variety of products.

### The Offering

Company .....	Auto-trol Technology Corporation
Security .....	Common Stock
Number of Shares Offered (1) .....	650,000
Common Stock Outstanding After Offering (1) .	4,462,070
NASDAQ Symbol .....	ATTC
Use of Proceeds .....	To repay short-term notes payable to banks

### Selected Financial Information (in thousands, except per share data)

	Year Ended December 31,					Six Months Ended June 30, (unaudited)	
	1978	1979	1980	1981	1982	1982	1983
<b>Operations Data:</b>							
Revenues .....	\$21,850	\$33,540	\$50,762	\$46,287	\$43,990	\$22,652	\$21,921
Earnings (loss) before income taxes .....	3,103	5,613	5,982	(5,629)	(10,052)	(1,925)	(4,660)
Net earnings (loss) .....	1,764	3,438	3,787	(3,272)	(7,568)	(1,155)	(4,660)
Net earnings (loss) per common share .....	.82	1.28	1.27	(1.04)	(2.10)	(.33)	(1.23)
Weighted average number of common shares outstanding .....	2,128	2,679	2,983	3,157	3,600	3,450	3,774

June 30, 1983  
(unaudited)

### Balance Sheet Data:

	Actual	As Adjusted (1)(2)
Working capital .....	\$ 4,136	\$14,399
Total assets .....	45,343	45,343
Short-term debt .....	13,451	3,188
Long-term debt .....	6,003	6,003
Redeemable Preferred and Class B Common Stock ....	781	781
Common Stock and other shareholders' equity .....	17,079	27,342

(1) Assumes the Underwriters' over-allotment option is not exercised. See "Underwriting."

(2) Adjusted to reflect the sale of the shares offered hereby and the anticipated application of net proceeds therefrom. See "Use of Proceeds."

See "Management's Discussion and Analysis of Financial Condition and Results of Operations" and "Recent Operating Results" for a discussion of the Company's operating losses and the anticipated results for the third quarter ended September 30, 1983.



## CAPITALIZATION

The following table sets forth the consolidated capitalization of the Company at June 30, 1983, and as adjusted to reflect the sale of the Common Stock offered hereby (assuming no exercise of the Underwriters' over-allotment option) and the reduction of bank borrowings described under "Use of Proceeds."

	June 30, 1983	
	Actual	As Adjusted
	(in thousands)	
Short-term debt (1) .....	\$13,451	\$ 3,188
Long-term debt (2) .....	\$ 6,003	\$ 6,003
Redeemable Preferred and Class B Common Stock:		
Preferred Stock, \$100 par value, issuable in series, 4,000 shares authorized: Series A Cumulative, 2,000 shares authorized, 309 shares outstanding – at mandatory redemption price of \$100 per share (3) ....	31	31
Class B Common Stock, \$.10 par value, 15,000 shares authorized, 15,000 shares outstanding – at mandatory redemption price of \$50 per share (3) .....	750	750
Total Redeemable Preferred and Class B Common Stock .....	781	781
Common Stock and other shareholders' equity:		
Common Stock, no par value, 10,000,000 shares authorized, 3,797,807 shares outstanding, 4,447,807 shares outstanding as adjusted (4) .....	24,713	34,976
Additional paid-in capital .....	269	269
Cumulative currency translation adjustments .....	(1,178)	(1,178)
Retained earnings (deficit) .....	(6,725)	(6,725)
Total Common Stock and other shareholders' equity .....	17,079	27,342
Total capitalization .....	\$23,863	\$ 34,126

(1) Includes \$11,826,000 of notes payable to banks and \$1,625,000 representing the current portion of long-term debt, of which \$1,385,000 represents the current portion of long-term lease obligations. See Note 3 of Notes to Consolidated Financial Statements. At October 17, 1983, notes payable to banks totalled \$13,596,000. All the proceeds of the offering will be used to repay these notes. See "Use of Proceeds."

(2) See Note 3 of Notes to Consolidated Financial Statements.

(3) Redeemable in annual installments. See "Description of Capital Stock" and Note 6 of Notes to Consolidated Financial Statements for more detailed information about redemption rights, dividend preferences and special voting rights of these classes of stock.

(4) Excludes 1,057,689 shares of Common Stock reserved for issuance under the Company's stock option and employee stock purchase plans, of which 14,263 have been issued since June 30, 1983. As of October 19, 1983, a total of 640,286 of the reserved shares were subject to outstanding options or purchase rights under these plans.

## SELECTED FINANCIAL DATA

The following summary of financial information of the Company should be read in conjunction with the consolidated financial statements and related notes appearing elsewhere in this Prospectus. The financial information for the six months ended June 30, 1982 and 1983 reflects all adjustments (consisting only of normal recurring adjustments) which are, in the opinion of management, necessary to a fair statement of the results for the interim periods presented (in thousands, except per share data). Results for the six months ended June 30, 1982 and 1983 are not necessarily indicative of results which may be expected for any other interim period or for fiscal 1983 as a whole.

	Year Ended December 31,					Six Months Ended June 30, (unaudited)	
	1978	1979	1980	1981	1982	1982	1983
<b>Summary of Operations:</b>							
Revenues:							
Sales .....	\$19,213	\$29,092	\$42,218	\$34,448	\$28,664	\$15,376	\$13,252
Service .....	2,637	4,448	8,544	11,839	15,326	7,276	8,669
	<u>21,850</u>	<u>33,540</u>	<u>50,762</u>	<u>46,287</u>	<u>43,990</u>	<u>22,652</u>	<u>21,921</u>
Costs and expenses:							
Cost of sales and service ...	11,211	17,368	25,991	25,852	27,682	12,280	13,691
Research and product development .....	3,015	4,059	6,123	7,956	8,102	3,717	4,145
Marketing, general and administrative .....	4,124	6,246	11,951	16,036	17,158	7,794	7,974
Interest, net .....	397	254	715	2,072	1,100	786	771
	<u>18,747</u>	<u>27,927</u>	<u>44,780</u>	<u>51,916</u>	<u>54,042</u>	<u>24,577</u>	<u>26,581</u>
Earnings (loss) before income taxes .....	3,103	5,613	5,982	(5,629)	(10,052)	(1,925)	(4,660)
Income taxes (benefit) .....	1,339	2,175	2,195	(2,357)	(2,484)	(770)	-
Net earnings (loss) .....	<u>\$ 1,764</u>	<u>\$ 3,438</u>	<u>\$ 3,787</u>	<u>\$ (3,272)</u>	<u>\$ (7,568)</u>	<u>\$ (1,155)</u>	<u>\$ (4,660)</u>
Net earnings (loss) per common share .....	<u>\$ .82</u>	<u>\$1.28</u>	<u>\$1.27</u>	<u>\$ (1.04)</u>	<u>\$ (2.10)</u>	<u>\$ (.33)</u>	<u>\$ (1.23)</u>
Weighted average number of common shares outstanding .....	<u>2,128</u>	<u>2,679</u>	<u>2,983</u>	<u>3,157</u>	<u>3,600</u>	<u>3,450</u>	<u>3,774</u>
<b>Period-End Financial Position:</b>							
Working capital .....	\$ 768	\$ 8,953	\$21,606	\$ 9,013	\$10,184	\$14,176	\$ 4,136
Total assets .....	11,628	33,303	49,607	50,757	40,921	46,918	45,343
Short-term debt .....	2,598	4,149	946	12,860	5,956	4,596	13,451
Long-term debt .....	1,456	5,969	8,845	6,652	5,794	6,424	6,003
Redeemable Preferred and Class B Common Stock ...	950	950	864	781	781	781	781
Common Stock and other shareholders' equity .....	1,760	11,591	26,832	23,427	21,667	27,505	17,079

## B. INFORMATION DISPLAYS, INC.

Financial Highlights (amounts in thousands, except per share data)

<u>Year End December 31</u>	<u>1982</u>	<u>1981</u>	<u>1980</u>	<u>1979</u>	<u>1978</u>
	\$	\$	\$	\$	\$
<u>Operations</u>					
Revenue	12094	7289	4267	4048	2534
Income(loss) before extraordinary credit	1068	340	(556)	110	(135)
Net income(loss)	1068	570	(556)	190	(135)
Net income(loss) per share before extraordinary credit	.50	.25	(.75)	.15	(.34)
Net income(loss) per share	.50	.42	(.75)	.26	(.34)
<u>Financial</u>					
Total assets	18366	11630	5257	4925	2870
Long-term debt	3243	1667	2668	2641	1122
Shareholders' equity	7813	6715	(23)	533	343
<u>Other</u>					
Book Value per common share	3.73	3.20	(.03)	.72	.46
Shares outstanding	2096	2096	740	740	740
Cash dividend	None	None	None	None	None

### Price Range of Common Stock - NASDAQ Symbol IDPY

		<u>Bid Price</u>		<u>Asked Price</u>	
		<u>High</u>	<u>Low</u>	<u>High</u>	<u>Low</u>
1982:	First Quarter	7	5 3/8	7 1/4	5 5/8
	Second Quarter	8 1/2	5 3/4	8 3/4	6
	Third Quarter	7 7/8	6 1/8	8 1/8	6 3/8
	Fourth Quarter	17	6 3/8	17 1/4	6 5/8
1981:	First Quarter	7 1/4	4 1/2	8 1/2	6
	Second Quarter	8 1/2	7	9 3/4	7 3/4
	Third Quarter	8 1/2	4 3/4	9 1/4	5 1/4
	Fourth Quarter	7 3/8	5 3/8	7 3/4	5 3/4

The range of high and low bid quotations is reported by the NASDAQ Intra-Dealer Quotation System without adjustment for retail mark-up, mark-down or commissions for each of the quarters of the fiscal years ended December 31st 1982 and December 31st 1981.



**INFORMATION DISPLAYS, INC.**

**CONSOLIDATED BALANCE SHEETS**

**A S S E T S**

	<b>December 31</b>	
	<u><b>1982</b></u>	<u><b>1981</b></u>
<b>CURRENT ASSETS</b>		
Cash.....	\$ 893,917	\$ 70,453
Short-Term investments—at cost—principally commercial paper and certificates of deposit (approximates market)	1,813,563	3,175,000
Accounts receivable, less allowance for doubtful accounts (1982—\$40,000; 1981—\$50,000) .....	2,695,590	2,015,532
Note receivable from Partnership—Note I.....		210,000
Inventories:		
Work-in-process.....	628,935	205,599
Materials and purchased parts.....	4,022,967	1,376,289
Total Inventories.....	<u>4,651,902</u>	<u>1,581,888</u>
Net investment in sales type leases—current portion— Note F.....	412,094	423,729
Prepaid expenses and other current assets.....	757,458	140,249
<b>TOTAL CURRENT ASSETS.....</b>	<u><b>11,224,524</b></u>	<u><b>7,616,851</b></u>
<b>MACHINERY AND EQUIPMENT—Note B</b>		
Equipment and leasehold improvements, net of accumu- lated depreciation and amortization (\$1,516,717—1982 and \$1,071,873—1981).....	4,508,529	2,078,796
Equipment subject to capital leases, net of accumulated depreciation (\$32,671—1981)—Note E.....		220,549
	<u>4,508,529</u>	<u>2,299,345</u>
<b>NET INVESTMENT IN SALES TYPE LEASES—less current portion—Note F .....</b>	<b>1,436,320</b>	<b>1,242,601</b>
<b>OTHER ASSETS—Note I.....</b>	<u><b>1,197,150</b></u>	<u><b>470,775</b></u>
	<u><u><b>\$18,366,523</b></u></u>	<u><u><b>\$11,629,572</b></u></u>

See notes to consolidated financial statements.

# INFORMATION DISPLAYS, INC.

## CONSOLIDATED BALANCE SHEETS

### LIABILITIES AND STOCKHOLDERS' EQUITY

	December 31	
	1982	1981
<b>CURRENT LIABILITIES</b>		
Notes payable—bank.....	\$ 1,450,000	
Notes payable—Partnerships—Note I.....	300,000	\$ 203,000
Current maturities of long-term debt—Note C.....	735,449	166,809
Current maturities of obligations under capital leases —Note E.....		115,359
Accounts payable.....	2,348,522	1,178,615
Accrued expenses.....	811,516	435,447
Deferred income—Note I.....	1,664,548	1,148,407
<b>TOTAL CURRENT LIABILITIES.....</b>	<b>7,310,035</b>	<b>3,247,637</b>
Obligations under capital lease arrangements (non- current)—Note E.....		231,151
Long-term debt—Note C.....	2,773,114	1,435,794
Note payable—Partnership—Note I.....	200,000	
Deferred income taxes—Note G.....	270,000	
	<b>10,553,149</b>	<b>4,914,582</b>
<b>STOCKHOLDERS' EQUITY—Note D</b>		
Common stock, par value \$.50 a share:		
authorized 4,000,000 shares, issued and outstanding 2,096,105 shares in 1982 and 1981.....	1,048,053	1,048,053
Additional paid-in capital.....	9,195,072	8,535,072
Accumulated deficit.....	(1,799,751)	(2,868,135)
	8,443,374	6,714,990
Less: Receivable relating to sale of warrant.....	(630,000)	
<b>TOTAL STOCKHOLDERS' EQUITY.....</b>	<b>7,813,374</b>	<b>6,714,990</b>
<b>COMMITMENTS AND CONTINGENCIES—Notes E and J</b>		
	<b>\$18,366,523</b>	<b>\$11,629,572</b>

See notes to consolidated financial statements.

# INFORMATION DISPLAYS, INC.

## CONSOLIDATED STATEMENTS OF OPERATIONS

	Year Ended December 31		
	1982	1981	1980
<b>Revenues:</b>			
Net sales and (in 1980) residual income from lease conversions.....	\$ 7,893,509	\$5,018,890	\$3,861,866
Sales type leases—Note F .....	387,000	1,666,330	
Lease rentals—Note F.....		127,677	356,508
Interest income .....	290,740	112,379	19,023
Research revenue from partnerships—Note I.....	3,450,102	353,592	
Other .....	72,294	10,068	29,855
	<u>12,093,645</u>	<u>7,288,936</u>	<u>4,267,252</u>
<b>Costs and expenses:</b>			
Cost of products sold and (in 1982 and 1981) research performed for partnerships—Note I..	6,412,895	3,316,504	2,121,109
Depreciation of equipment subject to operating leases assigned to others—Note F.....		52,827	166,428
Research and development.....	774,286	640,714	470,935
General, administrative and selling expenses.....	3,186,853	2,280,194	1,593,163
Interest expense .....	361,227	428,716	471,957
	<u>10,735,261</u>	<u>6,718,955</u>	<u>4,823,592</u>
Income (loss) before income taxes and extraordinary credit .....	1,358,384	569,981	(556,340)
Federal and state income taxes.....	290,000	230,000	
Income (loss) before extraordinary credit.....	1,068,384	339,981	(556,340)
Extraordinary credit—income tax benefit from utilization of loss carryforwards.....		230,000	
<b>NET INCOME (LOSS) .....</b>	<u><u>\$ 1,068,384</u></u>	<u><u>\$ 569,981</u></u>	<u><u>\$ (556,340)</u></u>
<b>Earnings (loss) per share—Note A:</b>			
<b>Primary:</b>			
Income (loss) before extraordinary credit ...	\$ .50	\$ .25	\$ (.75)
Extraordinary credit .....	<u>—</u>	<u>.17</u>	<u>—</u>
Net income (loss) .....	<u><u>\$ .50</u></u>	<u><u>\$ .42</u></u>	<u><u>\$ (.75)</u></u>
<b>Assuming full dilution:</b>			
Income (loss) before extraordinary credit ...	\$ .48	\$ .25	\$ (.75)
Extraordinary credit .....	<u>—</u>	<u>.17</u>	<u>—</u>
Net income (loss) .....	<u><u>\$ .48</u></u>	<u><u>\$ .42</u></u>	<u><u>\$ (.75)</u></u>

See notes to consolidated financial statements.



# INFORMATION DISPLAYS, INC.

## CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY

Years Ended December 31, 1982, 1981 and 1980

	6% Cumulative Convertible Redeemable Preferred Shares at Par	Common Shares at Par	Additional Paid-in Capital	Receivable for Stock Warrants	Accumulated Deficit	Total
Balance at January 1, 1980 .....	\$7,200	\$ 367,444	\$3,040,495		\$(2,881,776)	\$ 533,363
Redemption of 6% cumulative convertible redeemable pre- ferred shares.....	(7,200)	2,400	4,800			
Net loss for the year .....					(556,340)	(556,340)
Balance at December 31, 1980.....	<u>\$ -0-</u>	<u>369,844</u>	<u>3,045,295</u>		<u>(3,438,116)</u>	<u>(22,977)</u>
Conversion of 8-1/2% convertible subordinated notes.....		333,334	1,576,146			1,909,480
Sales and issuance of common shares .....		333,400	3,848,040			4,181,440
Exercise of stock options .....		125	625			750
Exercise of warrants.....		11,350	64,966			76,316
Net income for the year .....					569,981	569,981
Balance at December 31, 1981.....		<u>1,048,053</u>	<u>8,535,072</u>		<u>(2,868,135)</u>	<u>6,714,990</u>
Sale of stock warrants.....			660,000	\$(630,000)		30,000
Net income for the year .....					1,068,384	1,068,384
BALANCE AT DECEMBER 31, 1982.....		<u>\$1,048,053</u>	<u>\$9,195,072</u>	<u>\$(630,000)</u>	<u>\$(1,799,751)</u>	<u>\$7,813,374</u>

See notes to consolidated financial statements.

# INFORMATION DISPLAYS, INC.

## CONSOLIDATED STATEMENTS OF CHANGES IN FINANCIAL POSITION

Year Ended December 31

	<u>1982</u>	<u>1981</u>	<u>1980</u>
<b>SOURCE OF FUNDS</b>			
Provided from (used for) operations:			
Income (loss) before extraordinary credit.....	\$1,068,384	\$ 339,981	\$ (556,340)
Items not requiring working capital:			
Depreciation and amortization of machinery and equipment .....	539,010	406,385	366,190
Deferred income taxes.....	270,000		
Total provided from (used for) operations before extraordinary credit .....	1,877,394	746,366	(190,150)
Extraordinary credit.....		230,000	
<b>TOTAL PROVIDED FROM (USED FOR) OPERATIONS .....</b>	<b>1,877,394</b>	<b>976,366</b>	<b>(190,150)</b>
Additions (reductions) to obligations under capital leases, net of current maturities .....	(231,151)	(95,100)	115,346
Increase in long-term debt.....	2,174,965	1,435,794	
Sale of 666,800 shares of common stock .....		4,181,440	
Issuance of 666,667 shares of common stock on conversion of note.....		1,909,480	
Exercise and issuance of stock options and warrants, net in 1982 of \$630,000 receivable relating to sale of warrant .....	30,000	77,066	
Notes payable—partnership.....	200,000		
	<u>4,051,208</u>	<u>8,485,046</u>	<u>(74,804)</u>
<b>APPLICATION OF FUNDS</b>			
Liquidation of convertible subordinated note.....		2,000,000	
Net increase in investment in sales type leases .....	193,719	1,242,601	
Additions to equipment and leasehold improvements .....	2,748,194	824,640	1,313,720
Purchase (sale) of equipment subject to operating leases .....		(264,229)	72,986
Increase (decrease) in other assets.....	726,375	343,974	(12,692)
Reduction in long-term debt, net of current maturities .....	837,645	2,853	3,000
Reduction in obligations under operating leases, net of current maturities.....		339,185	77,768
	<u>4,505,933</u>	<u>4,489,024</u>	<u>1,454,782</u>
<b>INCREASE (DECREASE) IN WORKING CAPITAL.....</b>	<b>\$ (454,725)</b>	<b>\$3,996,022</b>	<b>\$ (1,529,586)</b>
<b>CHANGES IN COMPONENTS OF WORKING CAPITAL</b>			
Increase (decrease) in current assets:			
Cash .....	\$ 823,464	\$ (215,125)	\$ (951,953)
Short-term investments .....	(1,361,437)	3,175,000	
Accounts receivable, net.....	680,058	584,197	351,205
Net investment in sales type leases .....	(11,635)	423,729	
Note receivable .....	(210,000)	210,000	(20,000)
Inventories .....	3,070,014	419,991	(70,238)
Prepaid expenses and other current assets .....	617,209	34,318	15,463
	<u>3,607,673</u>	<u>4,632,110</u>	<u>(675,523)</u>
Increase (decrease) in current liabilities:			
Notes payable—bank .....	1,450,000	(1,000,000)	500,000
Notes payable—Partnerships.....	97,000	203,000	
Current maturities of long-term debt.....	568,640	153,809	(5,000)
Current maturities of obligations under capital leases .....	(115,359)	(52,601)	107,550
Current maturities of obligations under operating leases assigned to others.....		(377,537)	28,142
Accounts payable .....	1,169,907	284,860	299,451
Accrued expenses.....	376,069	276,150	(76,080)
Deferred income .....	516,141	1,148,407	
	<u>4,062,398</u>	<u>636,088</u>	<u>854,063</u>
<b>INCREASE (DECREASE) IN WORKING CAPITAL.....</b>	<b>\$ (454,725)</b>	<b>\$3,996,022</b>	<b>\$ (1,529,586)</b>

See notes to consolidated financial statements.

C.

The following table contains certain selected unaudited quarterly financial data which includes all adjustments management of the Company considers necessary for a fair presentation thereof.

	1982 Fiscal Quarter Ended			
	Mar 31	Jun 30	Sep 30	Dec 31
	(Amounts in thousands except per share data)			
Product sales	\$7,093	\$16,233	\$29,489	\$41,943
Software license sales	863	226	182	433
Total revenue	7,956	16,459	29,671	42,376
Cost of products sold	4,538	10,387	19,088	27,745
Net income	942	2,065	3,939	4,959
Net income per share	.04	.08	.13	.19
	1981 Fiscal Quarter Ended			
	Mar 31	Jun 30	Sep 30	Dec 31
	(Amounts in thousands except per share data)			
Product sales	\$1,222	\$1,395	\$1,629	\$5,762
Software license sales	147	145	235	2,570
Net sales	1,369	1,540	1,864	8,332
Cost of products sold	753	839	1,162	3,837
Net income (loss)	(162)	(109)	(470)	1,518
Net income (loss) per share	(.01)	(.01)	(.03)	.07

## STOCK PRICE HISTORY

	1982 Fiscal Quarter Ended			
	Mar 31	Jun 30	Sep 30	Dec 31
Common stock prices				
High Bid	—	9 <sup>7</sup> / <sub>8</sub>	11 <sup>7</sup> / <sub>8</sub>	25 <sup>3</sup> / <sub>4</sub>
High Ask	—	10		
Low Bid	—	7 <sup>1</sup> / <sub>8</sub>	7 <sup>1</sup> / <sub>4</sub>	13 <sup>5</sup> / <sub>8</sub>
Low Ask	—	7 <sup>1</sup> / <sub>4</sub>	7 <sup>3</sup> / <sub>8</sub>	

The Company's initial public offering was effective May 18, 1982, and since that date the company's stock has been traded in the over-the-counter market (NASDAQ symbol: CVGT). The above table reflects prices for the stock's high and low "bid" and "ask" prices through July 31, 1982 as furnished by the National Quotation Bureau, Incorporated. Starting August 1, 1982 the summary shows prices quoted by the NASDAQ

National Market System. Stock prices have been adjusted for the 3 for 2 stock split effective December 31, 1982, and thus do not reflect actual quoted prices.

The Company had approximately 1,808 shareholders as of December 31, 1982. The Company has not paid cash dividends on its common stock, and its Board of Directors presently intends to continue this policy in order to retain earnings for the development of the company's business. Accordingly, it is anticipated that no cash dividends will be paid in the foreseeable future.



	Year ended December 31,			August 3, 1979 to December 31, 1979
	1982	1981	1980	
(Amounts in thousands except per share data)				
Income statement data:				
Revenue:				
Product sales	\$ 94,758	\$10,008	\$ 307	—
Software license sales	\$ 1,704	\$ 3,097	\$ 44	—
Total revenue	\$ 96,462	\$13,105	\$ 351	—
Net income (loss)	\$ 11,915	\$ 777	\$(3,365)	\$(317)
Net income per share <sup>(1)</sup>	\$ .42	\$ .04	—	—
Weighted average number of common and common equivalent shares outstanding <sup>(1)</sup>	28,675	17,543	—	—
December 31,				
	1982	1981	1980	1979
(Amounts in thousands)				
Balance sheet data:				
Working capital	\$ 73,735	\$11,399	\$ 2,465	\$ (40)
Total assets	\$100,868	\$17,179	\$ 3,709	\$ 325
Long-term obligations and advance from customer	\$ 895	\$ 1,197	\$ 2,926	\$ 50
Shareholders' equity	\$ 79,604	\$12,154	\$ 446	\$ 128

Prior to January 1, 1981, the Company was a limited partnership and had no shares outstanding.

## MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

### Results of Operations

From its founding in August 1979 through the third quarter of 1980, the Company was in a research and development phase and there were no revenues. Initial production units were shipped in the fourth quarter of 1980 with revenues from such sales totaling \$307,000. In 1981, the Company's first full year of production, revenues from product shipments reached approximately \$10,000,000.

During each quarter of 1982, product shipments increased significantly, reflecting favorable market response to the Company's initial products and the introduction of enhancements of existing products and new products. These increases reflect significant levels of sales to the large OEM customers with which the Company has sales and licensing agreements and sales to other OEM customers.

In addition to hardware sales, the Company licenses systems and applications software developed by the Company and by third parties. Software license sales are separately set forth, except that revenue from software sold with specific workstations is included in product sales. As the software is generally developed for regular distribution with hardware, the Company's costs associated with the development of software are included in product development expenses in the period incurred which generally precedes the period in which software licenses are sold. Software license sales are, for the most part, made to large OEM purchasers, who generally make their purchases at the commencement of their contracts. As a result of a large number of software license sales to such OEM cus-

# CONSOLIDATED STATEMENTS OF INCOME (LOSS)

Convergent Technologies, Inc.  
and Subsidiaries

	Year ended December 31,		
	1982	1981	1980
	(Amounts in thousands except per share data)		
Revenue:			
Product sales	\$94,758	\$10,008	\$ 307
Software license sales	1,704	3,097	44
Total revenue	96,462	13,105	351
Costs and expenses:			
Cost of products sold	61,758	6,591	812
Product development	7,226	2,574	1,835
Selling and marketing	5,315	1,637	758
General and administrative	3,956	1,234	392
Operating income (loss)	18,207	1,069	(3,446)
Interest income	3,666	200	116
Interest expense	(269)	(127)	(35)
Income (loss) before provision for taxes on income	21,604	1,142	(3,365)
Provision for taxes on income	9,689	365	—
Net income (loss)	\$11,915	\$ 777	\$(3,365)
Net income per common and common equivalent share	\$ .42	\$ .04	—
Weighted average number of common and common equivalent shares outstanding	28,675	17,543	—

The accompanying notes are an integral part of these financial statements.

	At December 31	
ASSETS	1982	1981
	(Amounts in thousands except share data)	
Current assets:		
Cash and cash equivalents	\$ 27,291	\$ 6,011
Marketable securities	10,014	—
Trade accounts receivable, less allowance for doubtful accounts of \$754 in 1982 and \$137 in 1981	25,366	5,927
Inventories	30,077	3,143
Deferred income taxes	535	—
Prepaid expenses and other current assets	754	10
Total current assets	94,037	15,091
Property and equipment	6,735	—
Other assets	96	—
	\$100,868	\$17,191
LIABILITIES		
Current liabilities:		
Accounts payable	\$ 6,475	\$ 2,554
Accrued payroll and related expenses	2,156	219
Other accrued expenses	1,897	439
Deferred income	—	200
Income taxes payable	9,533	234
Deferred income taxes	—	44
Current portion of obligations under capital leases	241	97
Total current liabilities	20,302	3,787
Advance from customer	—	830
Deferred income taxes	67	41
Obligations under capital leases, less current portion	895	367
	21,264	5,025
Commitments (Notes 8 and 9).		
SHAREHOLDERS' EQUITY		
Preferred stock, no par value:		
Authorized 2,000,000 shares; issued and outstanding, none in 1982 and 1,833,294 shares in 1981	—	10,819
Common stock, no par value:		
Authorized 84,000,000 shares; issued and outstanding 30,037,605 in 1982 and 17,092,356 in 1981	68,224	558
Retained earnings	12,692	777
Less notes receivable from shareholders	80,916	12,154
	(1,312)	—
Total shareholders' equity	79,604	12,154
	\$100,868	\$17,179
The accompanying notes are an integral part of these financial statements		

The accompanying notes are an integral part of these financial statements



# CONSOLIDATED STATEMENTS OF SHAREHOLDERS' EQUITY

Convergent Technologies, Inc.  
and Subsidiaries

	Partners' Capital	Preferred Stock	Common Stock		Retained Earnings	Notes Receivable From Shareholders	Total
			Shares	Amount			
(Amounts in thousands except share data)							
Balance, December 31, 1979	\$ 128	—	—	—	—	—	\$ 128
Partners' capital contributions	3,700						3,700
Partners' capital withdrawals	(17)						(17)
Net loss for the year	(3,365)						(3,365)
Balance, December 31, 1980	446	—	—	—	—	—	446
Issuance of common stock:							
Conversion of partnership interests	(446)		15,731,931	\$ 446			—
Employee stock purchase agreements			559,425	10			10
Employee stock option plans			868,500	58			58
Issuance of 1,236,858 shares of Series A preferred stock upon conversion of promissory notes		\$ 2,500					2,500
Issuance of 596,436 shares of Series B preferred stock through private placement, net of expenses of \$31		8,319					8,319
Repurchase of common stock			(67,500)	(1)			(1)
Income tax benefit resulting from expenses incurred by the Partnership				45			45
Net income for the year					\$ 777		777
Balance, December 31, 1981	—	10,819	17,092,356	558	777	—	12,154
Issuance of common stock:							
Public offering, net of expenses of \$566			6,600,000	54,610			54,610
Conversion of 1,236,858 shares of preferred Series A and 596,436 shares of preferred Series B stock to common stock		(10,819)	5,499,882	10,819			—
Employee stock option plans			868,175	1,933		\$(1,318)	615
Repurchase of common stock			(22,808)	(105)		2	(103)
Repayment of notes receivable						4	4
Income tax benefit resulting from exercise of stock options				409			409
Net income for the year					11,915		11,915
Balance, December 31, 1982	\$ —	\$ —	30,037,605	\$68,224	\$ 12,692	\$(1,312)	\$79,604

Accompanying notes are an integral part of these financial statements.

	Year ended December 31		
	1982	1981	1980
	(Amounts in thousands)		
Resources provided:			
From operations:			
Net income (loss)	\$11,915	\$ 777	\$(3,302)
Add charges to income not requiring an outlay of working capital:			
Depreciation and amortization	1,616	364	114
Deferred income taxes	26	41	—
Resources provided by (applied to) operations	13,557	1,182	(3,288)
Decrease in long-term deposits	450	—	—
Proceeds from issuance of convertible promissory notes	—	—	—
Advance from customer	420	830	—
Increase in obligations under capital leases	851	46	—
Partners' capital contributions	—	—	—
Issuance of Series A preferred stock upon conversion of promissory notes	—	2,500	—
Net proceeds from issuance of Series B preferred stock	—	8,319	—
Issuance of common stock upon conversion of partnership interests	—	446	—
Issuance of common stock upon conversion of Series A and Series B preferred stock	10,819	—	—
Proceeds from issuance of common stock, net of notes receivable	55,634	68	—
Total resources provided	81,731	13,391	3,465
Resources applied:			
Acquisition of property and equipment	6,903	1,061	666
Increase in long-term deposits	—	300	150
Decrease in customer advance	1,250	—	—
Payments and current maturities of obligations under capital leases	323	105	91
Conversion of partner advance to partnership capital	—	—	50
Conversion of promissory notes to Series A preferred stock	—	2,500	—
Conversion of partnership interests to common stock	—	446	—
Conversion of Series A and Series B preferred stock to common stock	10,819	—	—
Other, net	100	45	3
Total resources applied	19,395	4,457	960
Increase in working capital	\$62,336	\$ 8,934	\$ 2,505
Increase (decrease) in working capital by components:			
Cash and cash equivalents	\$21,279	\$ 4,307	\$ 1,666
Marketable securities	10,014	—	—
Trade accounts receivable	19,439	5,646	281
Note receivable from general partner	—	—	(65)
Inventories	26,934	2,417	726
Deferred income taxes	579	(44)	—
Prepaid expenses and other current assets	650	14	86
Accounts payable	(3,921)	(2,432)	15
Accrued payroll and related expenses	(1,937)	(122)	(86)
Other accrued expenses	(1,458)	(391)	(48)
Deferred income	200	(200)	—
Income taxes payable	(9,299)	(234)	—
Current portion of obligations under capital leases	(144)	(27)	(70)
Increase in working capital	\$62,336	\$ 8,934	\$ 2,505

The accompanying notes are an integral part of these financial statements.

#### D. CAWDOR

- Cawdor is a U.K. based holding company owning two subsidiaries: Future Computers and Encotel.
- Encotel is a distributor of Superbrain, Televideo and Oki micros.
- Future Computers is the developer. Manufacturing is subcontracted to Thorn-EMI and believed to be running at a rate of between 500 and 1,000 a month) of the FX IBM Personalike.
- The CAWDOR company was formed in 1982 when Encotel decided to design its own range of micros and needed to raise funds to do so. The current arrangement was bought into being with £800,000 funding from the British Technology Group and APA Venture Capital which gave them 30% of the equity.
- CAWDOR's turnover for the year ended November 30th 1983 was approximately £4m, the previous year it achieved £3.3m with profits before tax of £159,000.
- CAWDOR is currently looking for more venture capital in order to increase its research and development and expand its dealer network.

#### E. TELEMETRIX

- Telemetrix is a raster-scan specialist founded in 1977 and based in the U.K. Approximately 90% of its revenues are derived from its wholly-owned subsidiary Westward Micro Systems. Westward designs and distributes CAD/CAM graphics terminals and workstations. It is believed to be the 5th largest supplier of graphics display terminals in Europe in terms of units. It is a large OEM supplier.
- In the year to June 1983 the company made £1.6m profit before tax on revenue of £5.8M. It is forecasting profits of £3.2M on revenues of £12.1M for 1984.
- The company employs 200 people of whom 33 are in research and development, 115 in production and 33 in sales.



- It sought a full stock exchange listing in 1983 offering 5,243,243 5p ordinary shares at 185p per share, valuing the company at £37M. The share issue was oversubscribed 37 times.

#### F. HYTEC MICROSYSTEMS

- Hytec is the U.K. based manufacturer of the Prelude Z80B micro and is in the process of developing a 32 bit machine to be released at the end of 1984. Venture capital being raised to fund this development.
- Revenue for the year ending August 1983 was £2.7M.
- For the current year it expects to make a profit before tax of £1M on £5M revenue.
- Newmarket (Venture Capital) has invested £450,000 for a 15% equity stake. It has also raised money from the NCC software development scheme and private sources.

#### G. BLEASDALE COMPUTERS

- Bleasdale manufacturers a 68000 based product line which has primarily been aimed at the academic market. The company was originally set-up to do microprocessor consultancy and training but started development of UNIX based systems and now has an installed base of some 80 systems. Average system cost is £17,500.
- In the fiscal year to August 1983 revenue was £700,000. Revenue is now running at the rate of up to £250,000 per month.
- Profits before tax for the fiscal year to August 1983 were £180,000. The profit forecast for the year to November 1984 is believed to be £300,000 on a forecast revenue of £2M.
- The company plans a flotation on the London Over the Counter Market. It is anticipated that 32.4% of the equity is to be placed for £600,000 and that in addition Barclays Bank are expected to invest a further £400,000.
- These investments will be used to promote the product line to a much wider market, buy in systems software and

to increase manufacturing capacity.

#### H. MICROMITE

- Micromite is an 18 month old start-up manufacturing a dual Z80 + 8086 processor based Fileserver for interconnecting CP/M based micros.
- Pre-tax profits are forecast at £700,000 for the year ending 30th November 1984. The first financial year to August 1983 showed a net loss of £262,000 on £100,000 turnover. Accounts for the two months to 31st October 1983 show a net loss of £70,000.
- The company has gone to the London Over The Counter Market through Harvard Securities to raise £712,000 on a forecast of £700,000 pretax profits for the year ending 30th November 1984.
- 2,972,212 ordinary shares were offered at 25p per share.





APPENDIX B.



## APPENDIX B : COMPETITIVE EQUIPMENT

o This Appendix contains the following information:

- Section A. PERSPECTIVE Descriptive Brochure  
Article from Informatics magazine  
about PERSPECTIVE.
- Section B. PRADOS Descriptive Material and  
Brochures.
- Section C. Advertisement for CODATA 3300.  
Descriptive sheet on CODATA 3300.  
CMC CODATA 3300 UK PRICE LIST.
- Section D. Competitive Equipment Characteristics.  
A list of characteristics of equipment  
competitive with DISER system.



A. PERSPECTIVE

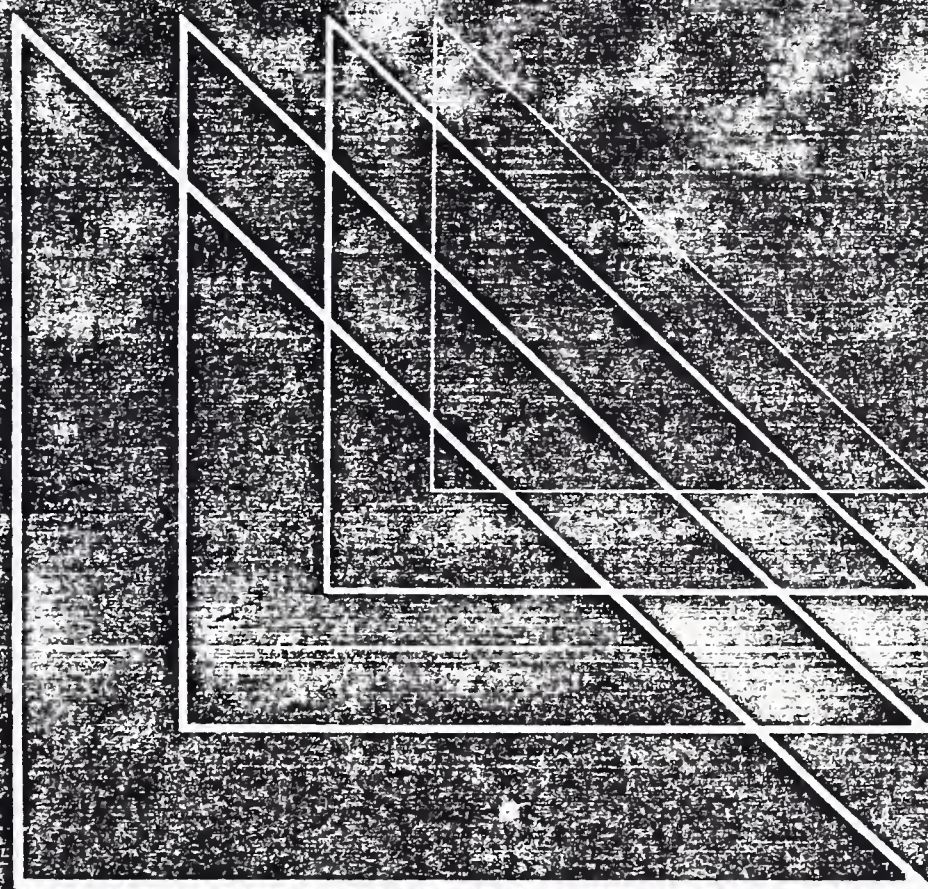








**Systems Designers**



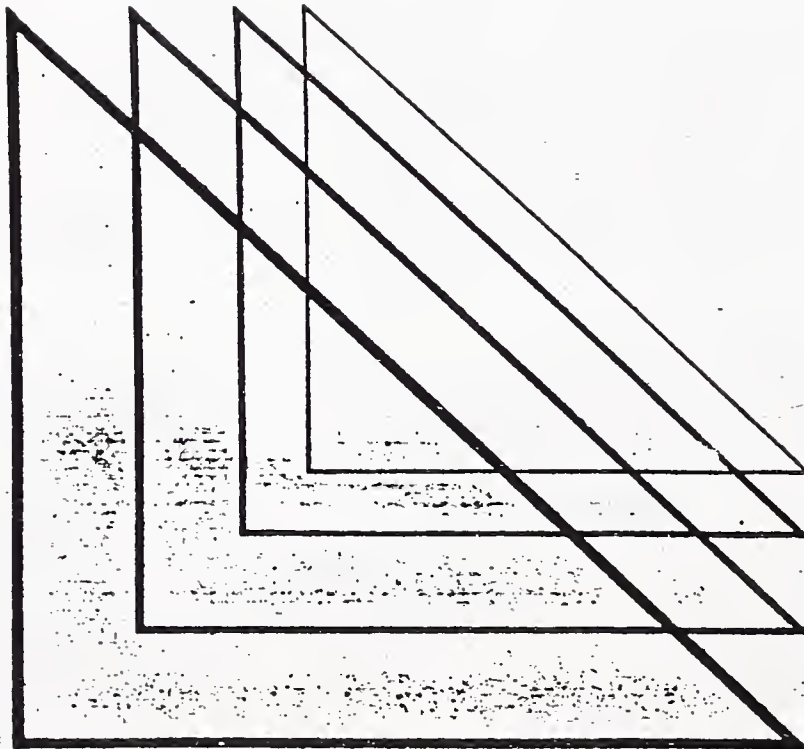
**Perspective**

**The Integrated Programming  
Support Environment**



## Problems tackled by Perspective

Real time systems  
Configuration control  
Management of  
• Software development  
• Project teams  
• Systems design  
• Quality  
Embedded micros  
Debugging and testing  
Multiprocessor systems  
Design checking  
Portable software



## Perspective

Perspective is an integrated set of tools running on the VAX 11 range of computers which helps your software development team design, program and test systems more efficiently. Just as important, it helps you manage the development, control the risks and complete software projects on time and within budget.

Perspective provides software development facilities for modern micro computers, yet it can be used for even the largest development projects. Special facilities are provided for real time systems so that the most complex of communications and control problems can be tackled.

The Perspective approach gives

- Better use of scarce resources
- Early elimination of risk
- Reduced development and maintenance costs
- Management control of software developments
- Protection of software investment

**Perspective facilities  
which help solve your  
software development problems  
include:**

#### **The Development Database**

At the heart of Perspective is a multi-user, multi-access database, which provides a common store of information for the project development team. All Perspective tools operate within the database, so the whole team, its tools, and its data are integrated into one unit all moving to a common goal.

#### **Programming Aids**

The Perspective tools, through their unique interaction with the central database, combine to produce a full programming support environment for the development of Pascal based software systems.

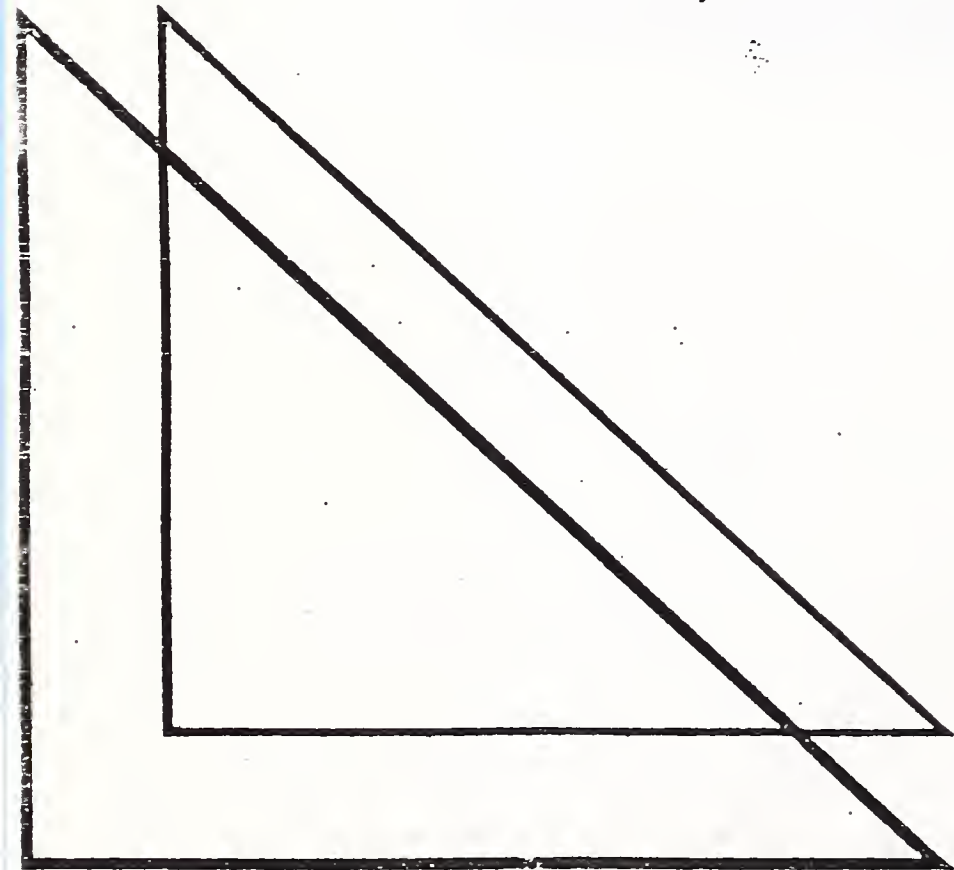
Once the design of the system is recorded in the database, Perspective knows how to build the system from its constituent components. For example, having made a change to an individual component, Perspective can automatically rebuild the system performing the minimum number of compilations and reloads. This minimises rebuild time and ensures compatability between source and binary versions of the system.

#### **Team Development**

Perspective recognises the particular problems of managing teams of software development staff. A secure environment is provided for the individual team member throughout development. Additional facilities allow him to release his work for integration into the overall system. Controls ensure that the programmer follows the design of the system as specified, reducing the risk of major delays during systems integration.

#### **Version Control and Configuration Management**

The version control and configuration management facilities within Perspective simplify the problems of integrating and testing software components developed by different members of the project team. Moreover they help managers to co-ordinate the building and maintenance of different systems, or different versions of the same system, using common components.





## The Manager's Perspective

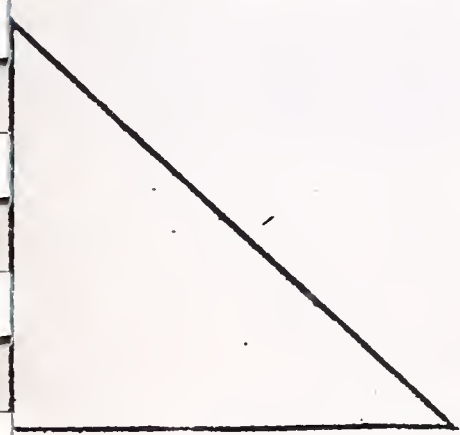
The person with primary responsibility for any project development is the manager. His main concern will be the satisfactory completion of his project:

- On time
- Within budget
- To specification
- With high quality and reliability

To achieve this both the project team and the manager himself must have the tools to do their individual jobs. **Perspective** provides these tools.

The manager works with information. His success depends on the accuracy, timeliness, and reliability of that information.

The central database within **Perspective** allows the manager to monitor progress on any item within the system. It also provides a unique level of control over the actions of the team members. The progress seen through the database does not rely on third party reports, it is a real and immediate view of the actual status at that time. By this means the manager can identify bottlenecks and problems early, and by taking action early can minimise risk to the project.



## The Designer's Perspective

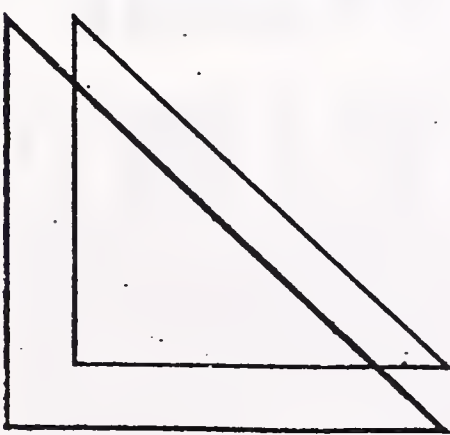
The designer has the task of designing a system which meets specific external requirements, and which the implementation team can build.

For many systems, and especially for real time microcomputer systems, it is essential that the design team follows a disciplined methodology. This process will lead to the specification of a set of components and their interactions.

**Perspective** allows this specification to be expressed in language extensions to Pascal and held within the central database. **Perspective** will then validate the design specification and thus provide for the earliest possible correction of any errors or omissions.

During the implementation phase **Perspective** will reject items which fail to conform to the design as recorded in the database.

In practice design changes during a project must be expected. In many cases this can result in implementation changes without the designer's knowledge or approval. **Perspective** will not permit this to happen and will force the designer's involvement in the decision process.

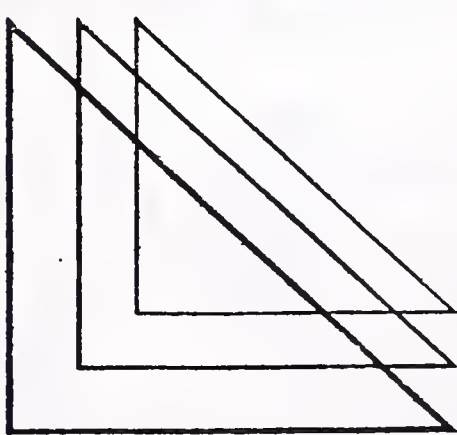


## The Programmer's Perspective

The programmer is responsible for implementing and testing specific components of the design system. **Perspective** recognises that he will be operating as a member of a team and consequently provides facilities to enable him to work independently as far as possible. At the same time it provides a disciplined environment in which programmers can interact with other team members.

Implementation is aided both by the tools (e.g. editor, Pascal compilers etc.) and particularly by the database, which provides a clear and unambiguous specification of the component design. This facilitates the task of creating component specific test harnesses.

The **Perspective** host/target approach to testing allows the programmer to see 'inside' the target microprocessor using debugging facilities which operate at the Pascal level. To re-use this tested software on other microprocessors, the programmer needs only to change the system description and **Perspective** will re-build the application for the new hardware, making use of the system construction information held within the central database.





**Perspective provides  
the tools essential for  
applications such as:**

**Control Systems**

**Power Generation Networks**

**Air Traffic Control**

**Production Line Monitoring**

**Energy Management**

**Alarm Systems**

**Command and Control**

**Avionics**

**Health Monitoring**

**Robotics**

**Urban Traffic Control**

**Communications Systems**

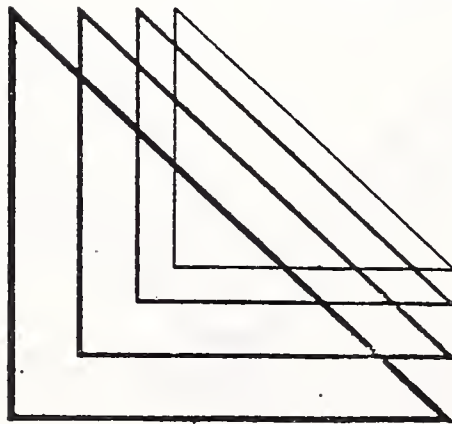
**Store and Forward Switches**

**Telephone Exchange**

**Teletex**

**Management Information Systems**

**Office Automation Products**



**Systems Designers**

Systems Designers is a leading British systems consultancy specialising in the high technology aspects of computing in the defence, telecommunications, financial and industrial markets. Services include consultancy, software and turnkey systems development, and a range of software products.

Formed in 1969, Systems Designers has expanded steadily and profitably, leading to the public flotation of the company in November 1982. This record of growth and profitability has provided the financial strength and security essential to attract top professional staff and to carry out major systems development projects.

Investment in research and development is essential to the company's position at the forefront of technology, and this involves some 10% of the company's professional resources.

Systems Designers has established a leading position in the highly technical area of advanced software technology. Main areas of activity have been requirements specification, real time design methods and programming support environments incorporating host-target techniques.

Research in these areas has stimulated the development of a range of industry standard software products; two of which have won ICP million dollar awards.



**SDL has turned a military-based engineering approach into a commercial product, writes Phil Manchester.**

**T**here has always been a conflict between the esoteric ideas put forward by the academic side of the computer community and the commercial expediency needed to turn them into products. The extended period that it has taken for Ted Codd's ideas on relational database and Edsger Dijkstra's ideas on structured programming to permeate through to the DP mainstream are but two examples.

Software engineering is a term that was coined around 15 years ago while the tools that can make it a reality have only just begun to emerge.

It is no surprise that the major source of the engineering-plus-toolkit approach has been, and will probably remain, the closed world of military computing.

Perspective, the winner of a British Computer Society award last autumn, is an attempt by Systems Designers (SDL) to synthesise this military-based engineering approach into a commercial product. It is a combination of a design approach, a programming environment and a management information system aimed at taking the heartache out of complex software development projects.

"The initial motivation for Perspective was to build a product which could be sold into the US market," explained the project manager, Ken Jackson.

The company already has a product called Context which uses many of the ideas that have been rejigged for use in Perspective. The major difference is the programming language supported by the two systems.

"Context was based on Coral 66 — which is all right for the UK as it is a Ministry of Defence standard. In Perspective we have thrown it out and replaced it with Pascal," said Jackson.

Both Perspective and Context are based on work that Jackson did at the Royal Signals and Radar Establishment, Malvern, before joining SDL. At RSRE Jackson, together with Royal Air Force systems man, Hugo Simpson, conceived the idea of Mascot — which stands for Modular Approach to Software Construction, Operation and Test — an attempt to formalise the software development process rigidly enough to suit the Ministry of Defence.

In many ways it was the forerunner of the Ada Program Support Environment now under development for the US Department of Defense. It allowed large scale embedded systems to be developed as isolated components and brought together in a final system without the usual problems of ill-fitting interfaces.

The specification and implementation of interfaces between components is a central theme in Mascot and it has been extended into Context and Perspective.

The Perspective project was under way when Jackson joined SDL in 1981 and it

was natural for him to want to influence it in the direction of his further refined ideas on Mascot.

SDL has always been closely linked with Mascot since its first public debut in 1978 so Jackson's task was not difficult. He commented: "We have taken Mascot's ideas of modularity of software and added a few new ideas — mainly to do with the component approach to design and construction. This is a marked difference to the Ada approach which still clings to the idea of program definitions."

"The design conventions used are analogous to engineering drawings."

"We have got to provide a component engineering approach to system development and that is as much to do with hardware as it is to do with software."

This is the cause which academics such as Tony Hoare at Oxford University and Manny Lehman at Imperial College London have been championing for some years now.

But what of commercial expediency? "Perspective offers a lot to the manager as well as the technician," said Jackson.

"One of the most important issues today is maintenance and we believe that Perspective is a major contribution both to the manager and the designer."

The centre of Perspective's management control system is a database contain-

ing a sort of overall specification of the system.

This covers the current status of its component parts through the development and live running phases together with the availability of those components to the system.

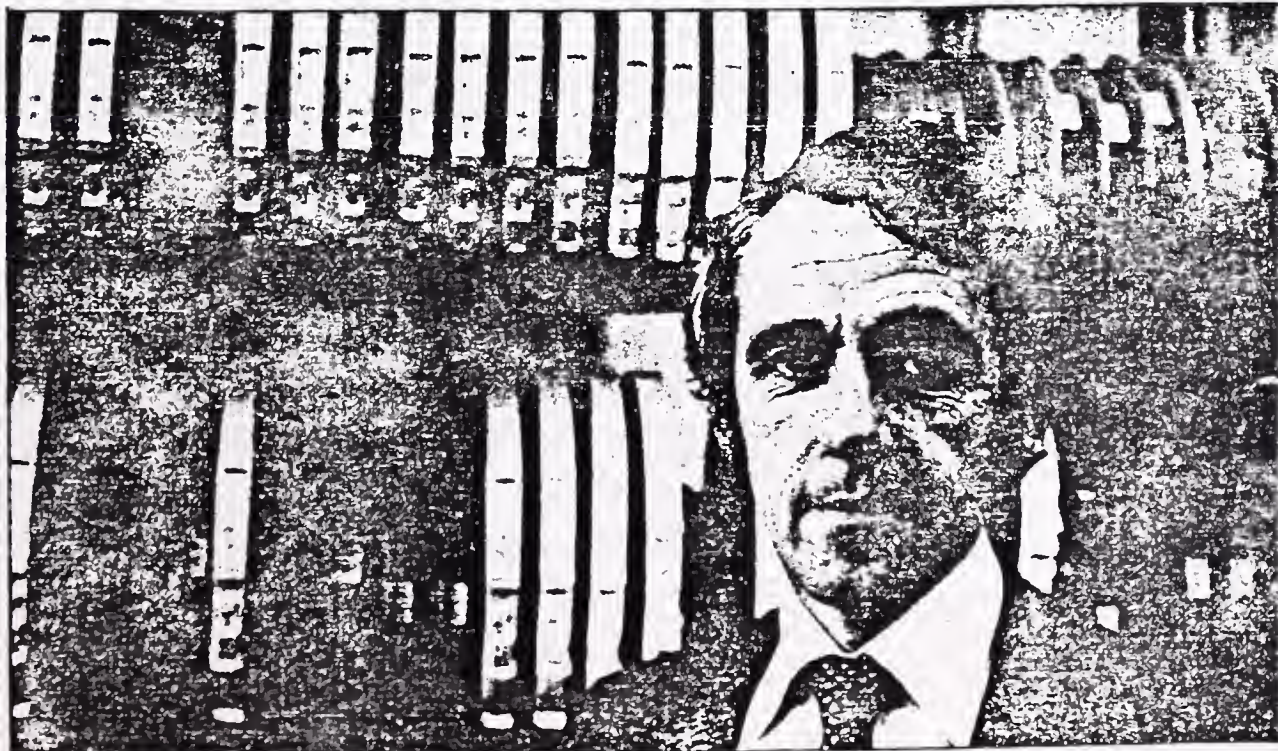
Having broken the project down into its component parts, the database acts as a method of synthesising the system into a coherent whole.

Those components that are still under development can be replaced by testing harnesses until the component is ready. "We have developed the notion of 'publishing' a module in the database," Jackson explained. "Once a programmer has completed work on a component it is made available to the rest of the system and the rest of the team by being published. If it becomes necessary to replace it with a new version, this can all be controlled through the database."

SDL hopes that this aspect of rigorous project control will appeal to the commercial market by offering a whole package. The project control mechanisms are essentially an extension of the 'toolbag' so that they are always closely linked to the actual technical progress of the project.

Jackson sees this as a vast improvement on the current and past subjective methods of project control.

# Putting Context into Perspective



**Jackson: "The initial motivation was to build a product which could be sold into the US"**



There are other advantages to this approach. Modern software development has had to pay much more attention to making software transportable across a range of machines and Perspective recognises this.

The database contains sufficient information about the system to act as a sort of code generator so that a system written for one target processor may be regenerated for another with no extra work. A selection of tools is provided with Perspective to facilitate testing on target processors.

This means that a newly created system for a specific target processor can be 'debugged' from the host processor. SDL claims that it is just as easy to do this in the later maintenance and even to upgrade phases of a system as it is during initial program development.

Together with a set of tools for creating PROM programs, this aspect of Perspective could prove highly attractive to software developers in many areas.

The decision to support Pascal as the programming language has not been without its problems.

SDL has had to extend Pascal to suit the Perspective philosophy because in Jackson's words, "the language is totally unsuitable for developing major commercial or real-time projects". There is a precedent here. Coral 66 was 'enhanced' — extension is a dirty word in MOD circles

— to cope with Mascot.

The major objection to standard Pascal defined by the British Standards Institute and the International Standards Organisation is that it has no concept of separate compilation or modularity, according to Jackson.

Combining ideas from Mascot and Ada, the Pascal Language Extensions — Pale — used in Perspective support several new ideas in programming. Chief among them is probably the concept of separating the specification of an interface between two components from its actual implementation.

What this means in practice is that you can have only one specification but any number of implementations. In use the two must be brought together so an interface is always specified in terms of both its characteristics and its implementation. This has particular importance in the implementation of multiple parallel processes — already a common problem in embedded systems and likely to become one in the future for commercial users using large networked systems.

Another aspect of Pale is that of enforcing modularity, an idea which comes from Mascot. Jackson notes that this eliminates the concept of universally accessible data or global data.

In other words absolute control is exercised over the flow of data from one 'process' to another.

All three of these ideas — the interface, its implementation and the modular process are separate compilation units under the Pale regime.

This formal approach to developing software sounds complex and the rigorous definitions that Jackson gives will probably turn a lot of Cobol programmers off. Unfortunately — for the Cobol programmers at any rate — the future is likely to need this approach as systems become more complex and make increasing use of multiple processor architectures and networks.

Jackson is not content to stop there, however. His work at SDL now covers the specification of a new version of Mascot which will take many of the lessons learnt in building Perspective and extend them even further.

Mascot 3, as it will be known, will include an extended version of the interfacing ideas explained above culminating in what Jackson calls a Composite Intercommunication Data Area (CIDA). This will allow multiple 'windows' through the same interface and Jackson sees it as a possible solution to the age old problem of polling in communications systems.

At the same time he is busy working on combining Mascot with Unix. "An American colleague named it Angus," said Jackson. What does it stand for? "Another Goddam Unix System," Jackson replied wryly. ■

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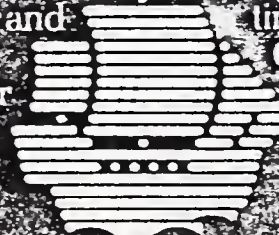
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B. PRADOS

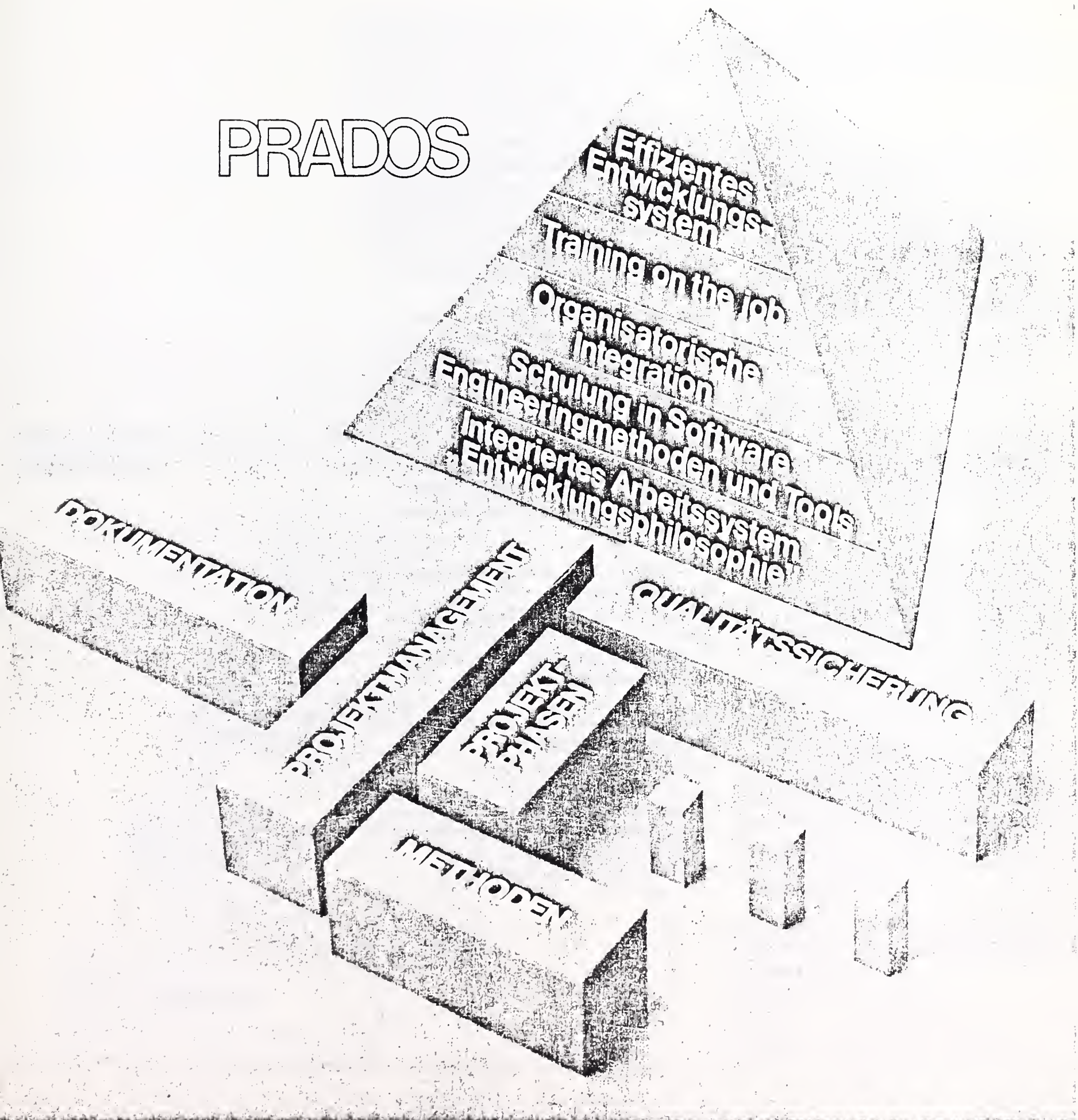




# SCS PRADOS

Projektabwicklungs- und Dokumentationssystem

## PRADOS



# Einführung

SCS hat seit der Unternehmensgründung 1969 weit über 1000 Projekte aller Größenordnungen auf dem Gebiet der professionellen Software-Entwicklung durchgeführt und dabei umfangreiche Erfahrungen mit Projektabwicklungsmethoden und Software-Werkzeugen gesammelt.

Die systematische Auswertung dieser Erfahrungen bildet die Grundlage, auf der unter Berücksichtigung neuester Erkenntnisse des Software-Engineerings das **PR**ojekt- **A**bwicklungs- und **D**okumentations-System **PRADOS** entstand.

Mit PRADOS bietet SCS umfassende Unterstützung bei der Lösung von Entwicklungs-, Wartungs- und Management-Aufgaben.

PRADOS ist an die unternehmensspezifischen Anforderungen anpaßbar. PRADOS umfaßt ein Schulungs- und Einführungskonzept und Software-Werkzeuge, die die Methoden und die Projektabwicklung unterstützen.

SCS ist Partner für die erfolgreiche Softwareproduktion durch

- Beratung im Bereich des Software-Engineering
- Lieferung angepaßter Hilfsmittel bis hin zu schlüsselfertigen Software-Entwicklungsmaschinen
- Methoden- und Fachtraining



# Konzept

**PRADOS – der systematische Ansatz**  
Die Nachfrage nach wirksamer Unterstützung der Softwareproduktion ist in den vergangenen Jahren ständig gestiegen, denn sie ist eine Voraussetzung zur Lösung der herausfordernden Aufgaben:

- Produktivitätssteigerung bei der Softwareerstellung
- Qualitätsverbesserung der Software und
- Reduzierung der Wartungsaufwendungen.

Es sind viele Ansätze für Software-Methoden und -Werkzeuge gemacht worden, wobei die meisten aber über die Probeinstallation nie hinausgekommen sind.

Die Ursachen für diese unbefriedigende Entwicklung sind sehr komplex; hauptsächlich liegen sie jedoch in

- mangelnder Durchdringung des Software-Entwicklungsprozesses in methodischer Hinsicht,
- fehlender organisatorischer Vorbereitung der Nutzung neuer Produktionstechniken,
- psychologischen Barrieren bei den Entwicklern und
- nutzerunfreundlichen Software-Werkzeugen.

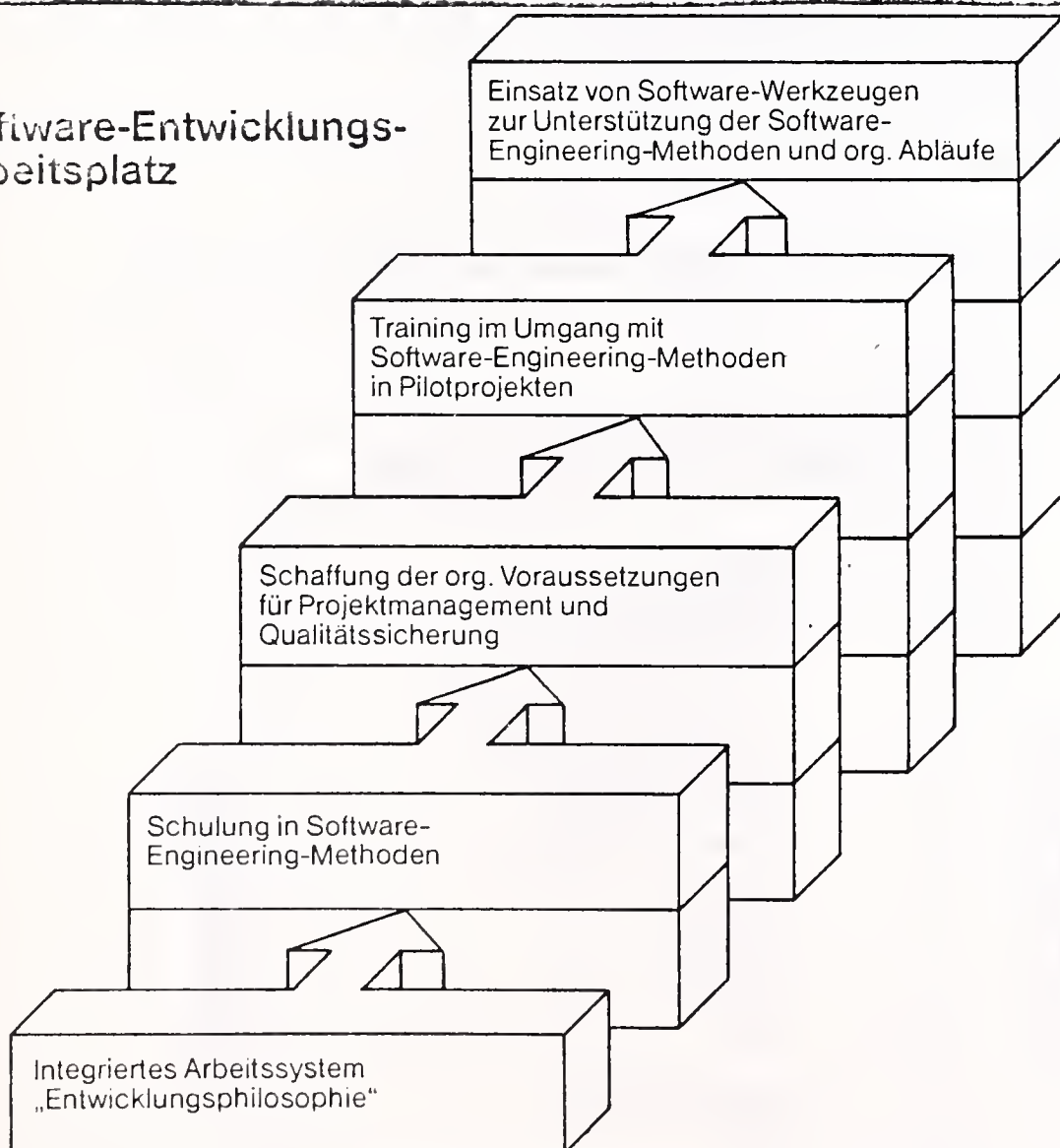
PRADOS entstand nach eingehenden Analysen der Fehlentwicklungen und ist ein systematischer Ansatz zur Problemlösung.

Die Grundlage von PRADOS ist das Modell eines Software-Entwicklungs-Arbeitsplatzes. Dieses Modell berücksichtigt die Erfahrung mit Standards, eine dem Software-Entwicklungsprozeß angepaßte Organisation und eine zielgerichtete Ausbildung der Entwickler in Software-Engineering-Methoden ebenso wie Software-Werkzeuge und die ergonomische Arbeitsplatzgestaltung. Damit diese unterschiedlichen Maßnahmen und Hilfsmittel einen integrierenden leistungssteigernden Effekt verursachen, ist eine gemeinsame Grundlage notwendig – die in einem Arbeitssystem niedergelegte Entwicklungsphilosophie.

Kernstück von PRADOS ist ein integriertes Arbeitssystem, das die folgenden Komponenten in sich vereint

- PRADOS – Projektphasen
- PRADOS – Projektmanagement
- PRADOS – Qualitätssicherung
- PRADOS – Software-Methoden-Richtlinien

## Software-Entwicklungs-Arbeitsplatz



Aufbauend auf den im Arbeitssystem niedergelegten Entwicklungsrichtlinien hat die SCS-Akademie ein **Schulungsprogramm** entwickelt, das die umfangreichen Erfahrungen verwertet, die SCS beim Methodentraining in den letzten Jahren gewonnen hat.

Kurse und Workshops sind Voraussetzungen für die Einführung neuer Methoden. Das Erlernen einer sinnvollen und der Projektsituation angepaßten Anwendung der Methoden sollte jedoch in der Projektarbeit von einem **Methodenberater** unterstützt werden. Methodenberater sind bei SCS erfahrene Mitarbeiter, die das methodische Vorgehen im Projekt ebenso beherrschen wie die Bewältigung organisatorischer Probleme bei der Durchführung von Projektmanagement- und Qualitätssicherungsaufgaben. Das Konzept des Methodenberaters sichert kurzfristig den Einführungserfolg und langfristig die wirkungsvolle Anwendung der Methoden.

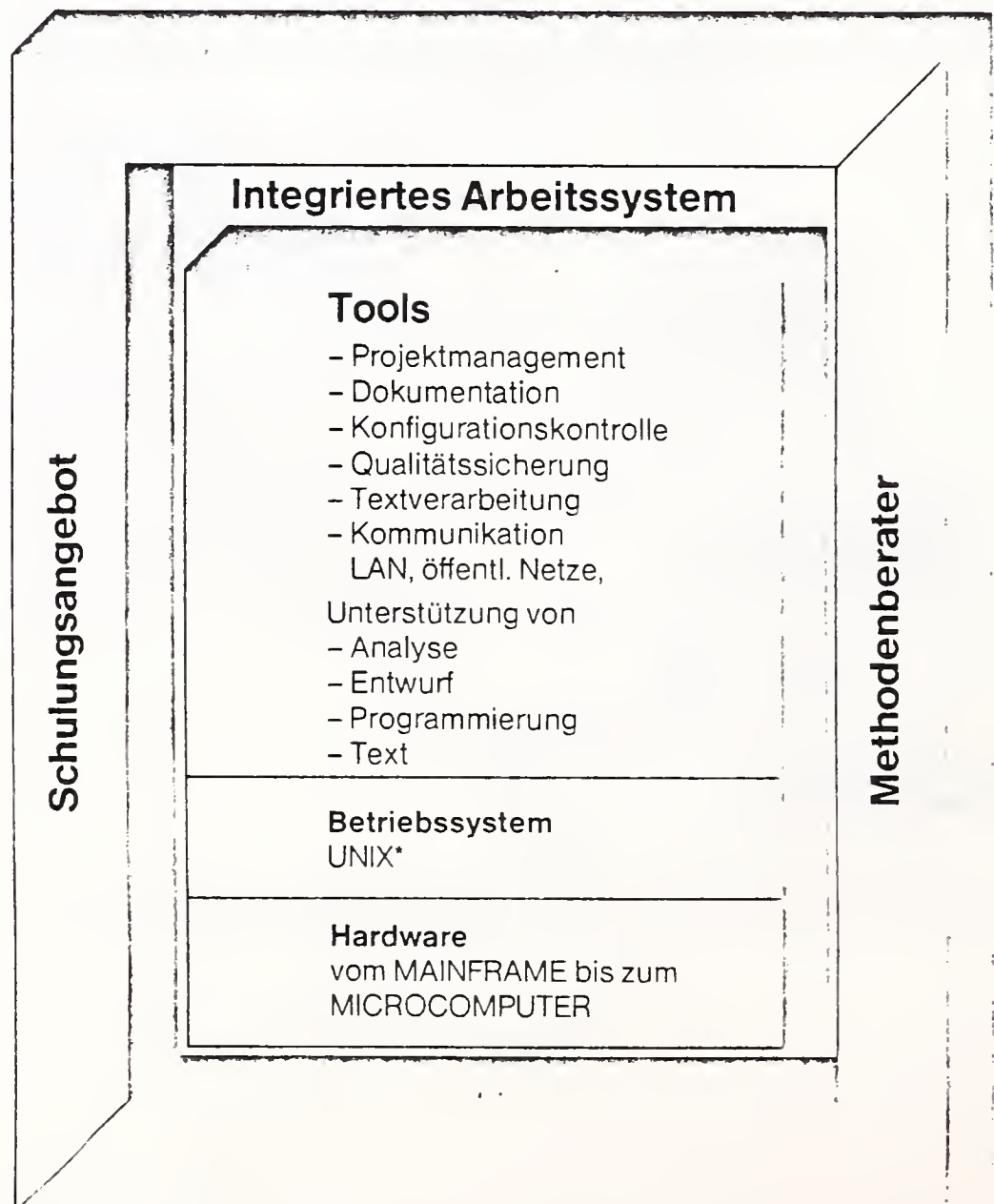
Die Akzeptanz der Methoden hängt aber nicht zuletzt von der nutzerfreundlichen Unterstützung des Software-Entwicklungsprozesses durch Software-Werkzeuge ab. Als Bestandteil von PRADOS wurde daher die „Projektmaschine“ entwickelt, die die Systemunterstützung für PRADOS liefert.

- Im einzelnen wurden dabei folgende Schwerpunkte gesetzt:
- Unterstützung des gesamten Software-Life-Cycles
  - Weitgehende Automatisierung der Herstellung der Konsistenz in der Projektdokumentation
  - Portabilität des Gesamtsystems auf Rechner verschiedener Hersteller
  - Umfangreiche Unterstützung des Nutzers durch integrierte Help-Funktionen
  - Berücksichtigung der ergonomischen Erkenntnisse bei der Gestaltung des Software-Entwicklungs-Arbeitsplatzes

- Kommunikationsmöglichkeiten zwischen der Projektmaschine und verschiedenen Zielrechnern.

Die klare Konzeption von PRADOS und der modulare Aufbau erlauben es, eine nutzerspezifische Software-Produktions-Umgebung zu schaffen, die firmenindividuelle Gegebenheiten und bereits eingeführte Vorgehensweisen berücksichtigt. Die Verwendung von Standardkomponenten sichert die Wirtschaftlichkeit. Die Portabilität erzeugt Unabhängigkeit von Hardware-Herstellern und ermöglicht auch die Nutzung zukünftiger preiswerter Computergenerationen.

Einzelheiten über die PRADOS-Komponenten enthalten die folgenden Kapitel.



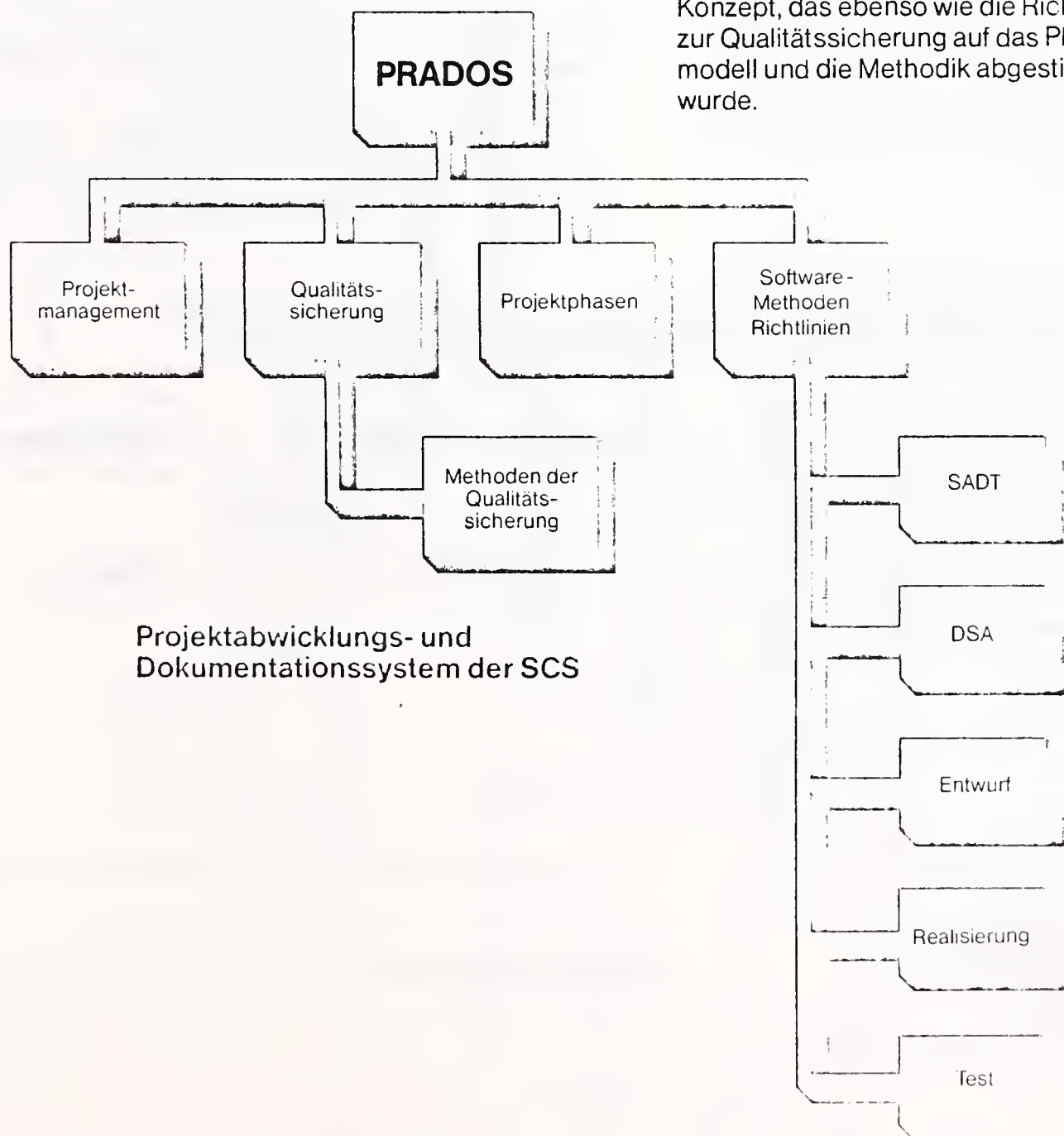
\*UNIX ist ein Warenzeichen der Bell Labs



# PRADOS – Arbeitssystem

PRADOS-Arbeitssystem – mehr als nur ein Phasenmodell  
Arbeitssysteme bestanden in den siebziger Jahren im wesentlichen aus Phasenkonzepten, die durch Checklisten angereichert waren. Manche Ansätze – wie zum Beispiel das Arbeitssystem ASS von SCS – berücksichtigen auch Projektmanagementaspekte und enthielten eine Dokumentationssystematik.

Das PRADOS-Arbeitssystem geht einen entscheidenden Schritt weiter. Die Integration eines durchgängigen Methodenkonzeptes mit einem Phasenmodell führt zu einer methodischen und damit präzisen und zeitsparenden Vorgehensweise bei der Software-Erstellung und -Pflege. Für Transparenz des Entwicklungsprozesses hinsichtlich der Leistung, Termine und Kosten sorgt das bei SCS seit Jahren erprobte Projektmanagement-Konzept, das ebenso wie die Richtlinien zur Qualitätssicherung auf das Phasenmodell und die Methodik abgestimmt wurde.



Projektabwicklungs- und Dokumentationssystem der SCS

### PRADOS/PM – das bewährte Projektmanagementkonzept

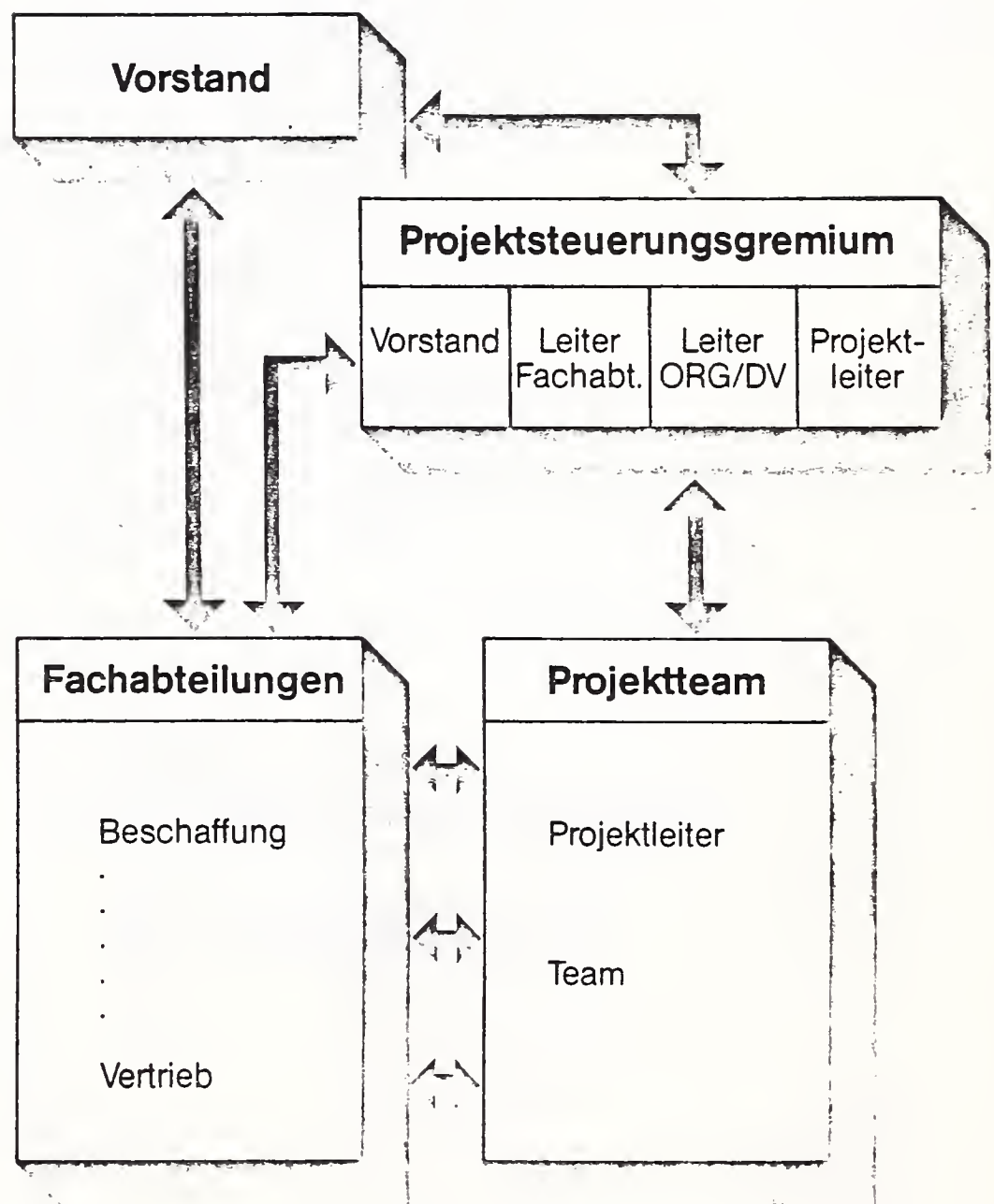
Projekterfahrung ist bei SCS kein leeres Schlagwort. Über 3000 Mannjahre Softwareproduktionserfahrung auf allen Gebieten der Software-Entwicklung haben gezeigt, welche Management-Methoden für die erfolgreiche Abwicklung von Projekten sinnvoll und wirtschaftlich vertretbar sind, aber auch, auf welche Modeerscheinungen man getrost verzichten kann.

PRADOS/PM zeigt in einer systematischen auf der Analyse- und Entwurfs-Methode SADT basierenden Darstellung die wesentlichen Elemente und Methoden der Projektplanung und -steuerung. Projektmanagement wird als kontinuierliche, projektbegleitende Aufgabe mit Regelkreischarakter beschrieben. Der vorausschauende Aspekt spielt dabei eine besondere Rolle, so daß mit den Erfahrungen der Vergangenheit und den Steuerungsdaten der Gegenwart die richtigen Entscheidungen für die zukünftige Entwicklung eines Projektes getroffen werden können.

Schwerpunktmäßig werden dabei die Themen

- Zielfindung
  - Problemabgrenzung und -strukturierung
  - Projektorganisation
  - Zeit- und Mittelplanung
  - Termin-, Kapazitäts- und Kostenplanung
  - Durchführung, Überwachung und Steuerung
- behandelt.

PRADOS/PM wird von Rechnern unterstützt. Eine Einführung im Umgang mit PRADOS/PM vermittelt das Seminar Projektmanagement I.



### Projektmanagement

### PRADOS/QS – die wirtschaftliche Qualitätssicherung

In vielen erfolgreichen Projekten ist ein nennenswerter Teil der Projektaufwendungen für die Qualitätssicherung bereitgestellt worden. Die Berichte weisen übereinstimmend aus, daß gerade diese Aufwendungen einen wesentlichen Beitrag zum Projekterfolg geleistet haben. Qualitätssicherung ist also nur auf den ersten Blick teuer.

Die Erfahrungen von SCS mit technischen und kommerziellen Projekten für öffentliche Auftraggeber und private Unternehmen bilden die Grundlage für die Gestaltung der Qualitätssicherungsrichtlinie PRADOS/QS und des ergänzenden Handbuches „Methoden der Qualitätssi-

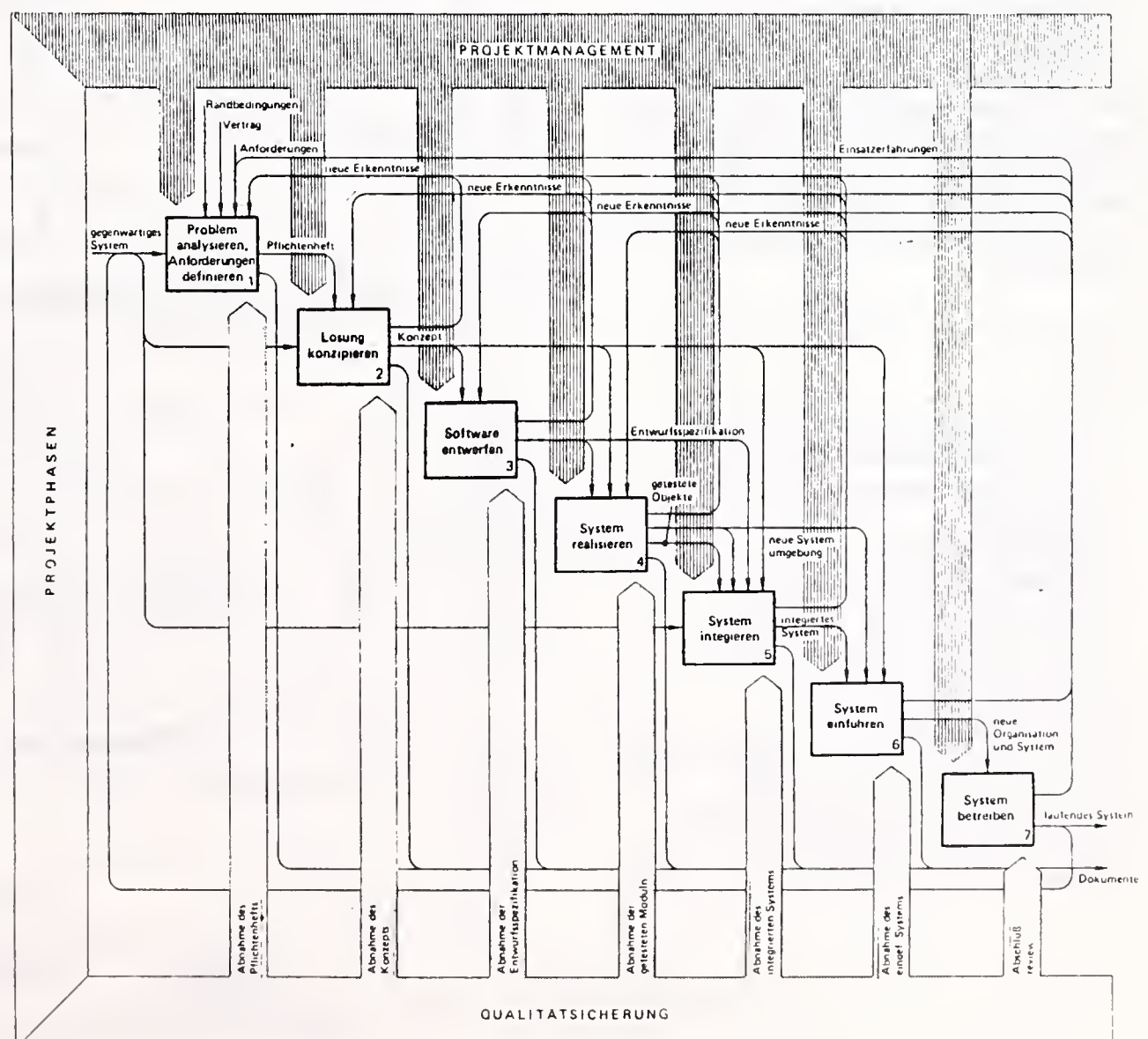
cherung“. PRADOS/QS verbindet einen Maximalkatalog von QS-Maßnahmen, wie sie z.B. in technisch-kritischen Projekten angebracht sind, mit einer wirtschaftlich orientierten Vorgehensweise.

Qualität hat sich an Projektzielen und finanziellen Möglichkeiten zu orientieren.

PRADOS/QS behandelt:

- Organisation der Qualitätssicherung
- Erstellen des Qualitätssicherungsplanes
- Standards und Richtlinien
- Konfigurationskontrolle
- Qualitätskontrolle

Der Einsatz von PRADOS/QS wird in einem Workshop trainiert.





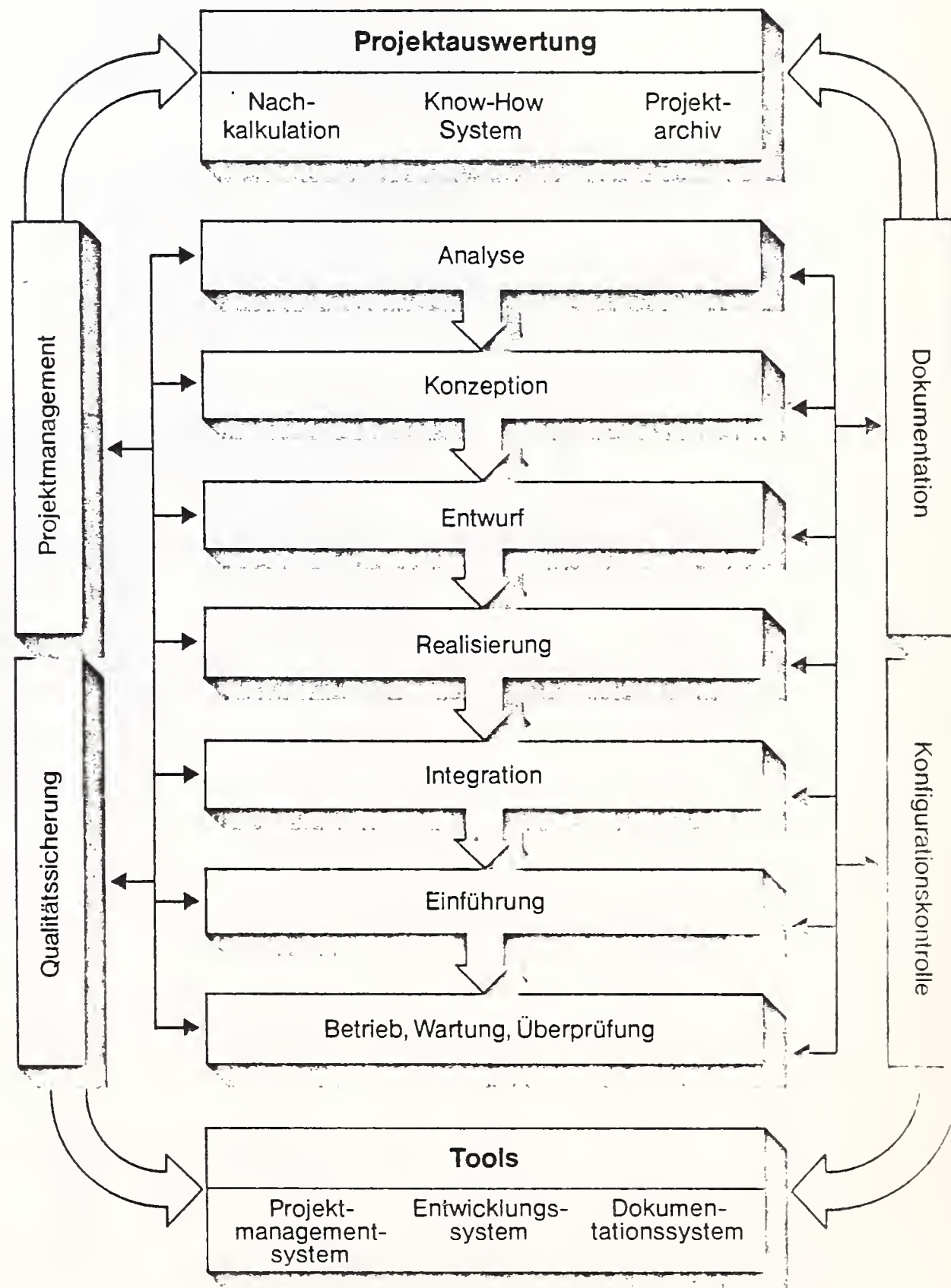
## PRADOS/PH – das individuelle Phasenkonzept

Phasenkonzepte zur Software-Entwicklung gibt es beinahe so viele wie Unternehmen, die die Konzepte nutzen. Obwohl diese Konzepte sich weitgehend gleichen und in großen Zügen ähnliche Phasenaufteilungen des Software-Life-Cycles vorschlagen, sind erhebliche Aufwendungen für die Anpassung an die unternehmensspezifischen Belange geleistet worden, weil sich die Software-Entwicklung als Dienstleistungsbereich in die Organisation des Unternehmens sinnvoll einpassen muß.

PRADOS/PH ist ein Phasenkonzept, das durch seinen hierarchischen Aufbau und die zur Darstellung gewählte Methode SADT einen genau definierten Rahmen bietet, der auf die individuellen Anforderungen des Nutzers leicht angepaßt werden kann.

Die wesentlichen Vorteile bleiben dabei erhalten:

- Klare Definition der Voraussetzungen und Ergebnisse einer Phase
- Integration der phasenspezifischen Methoden
- Integration von Projektmanagement und Qualitätssicherung
- Leichte Erlernbarkeit durch hierarchischen Aufbau
- Möglichkeit zur individuellen Detaillierungstiefe
- Schaffung der Voraussetzungen für eine standardisierte Dokumentation
- Unterstützung der Projektkalkulation
- Aufteilung eines Projekts in übersehbare, wohldefinierte Abschnitte





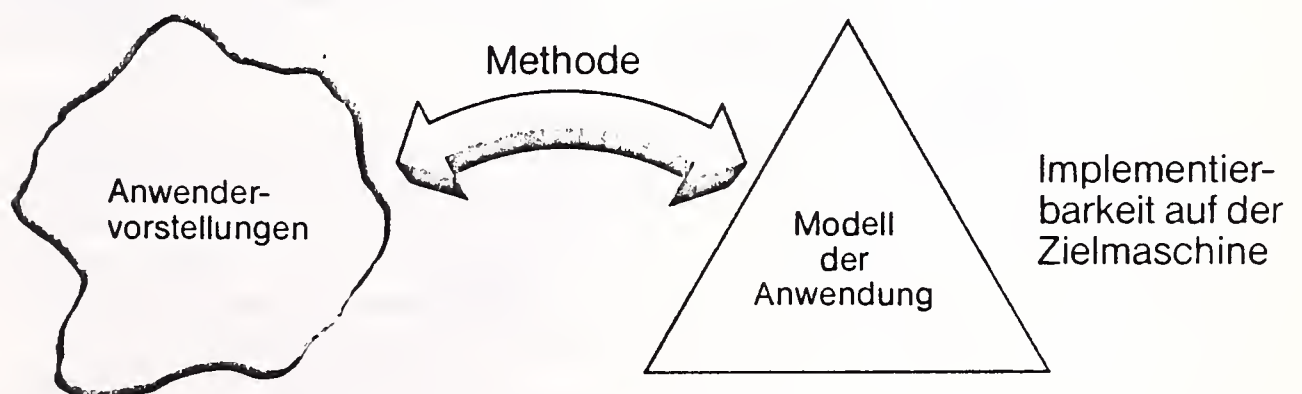
**PRADOS/MR – der durchgängige Methoden- und Richtlinienansatz**  
 Die Software-Methoden-Richtlinien PRADOS/MR ist exakt auf die Projektphasen PRADOS/PH abgestimmt und beschreibt die methodische Unterstützung der Arbeit in den Projektphasen sowie die Übergänge zwischen den Phasen. Die Auswahl der Methoden stellt eine Synthese aus bewährten, eingeführten Methoden und der Umsetzung neuer Erkenntnisse des Software-Engineerings in praktikable Vorgehensweisen dar.

### Analyse

Die Analysephase wird wesentlich beeinflusst durch den Kommunikationsprozeß zwischen dem Nutzer des zukünftigen Systems und dem Ersteller. Die erheblichen Wartungsaufwendungen während der späteren Betriebsphase werden hauptsächlich durch die mangelhafte Verständigung der beteiligten Parteien verursacht. SCS hat sich für zwei Methoden entschieden, die nicht zuletzt wegen ihrer graphischen Unterstützung den Kommunikationsprozeß fördern und zu einer vollständigen, konsistenten Analyse führen.

Für die funktionale Analyse wird die seit Jahren bewährte Methode SADT (Structured Analysis and Design Technique) eingesetzt. SCS hat diese Methode durch die objektbezogene Analysemethode DSA (Datenstruktur-Analyse) ergänzt. Das Zusammenspiel dieser Methoden beleuchtet die Problematik aus zwei verschiedenen Blickwinkeln und ermöglicht die Aufdeckung von Inkonsistenzen und Lücken. SADT und DSA werden in Seminaren der SCS Akademie geschult.

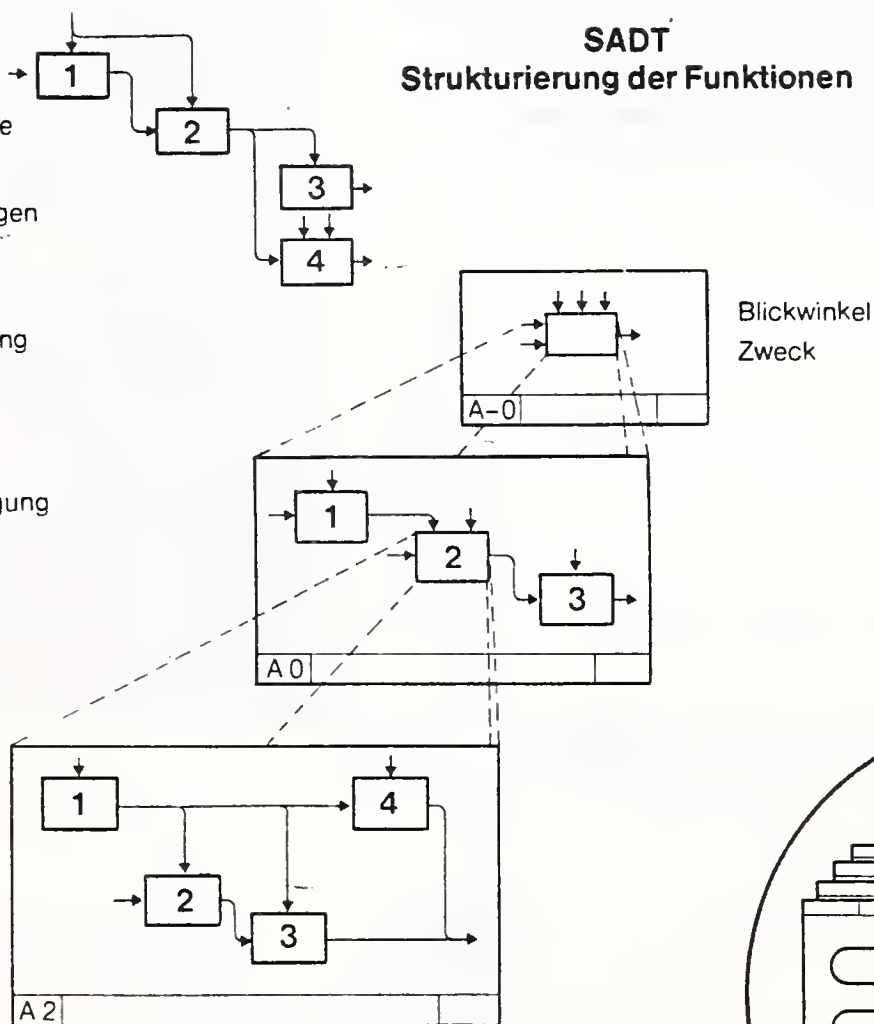
### Kommunikationsproblem



## SADT

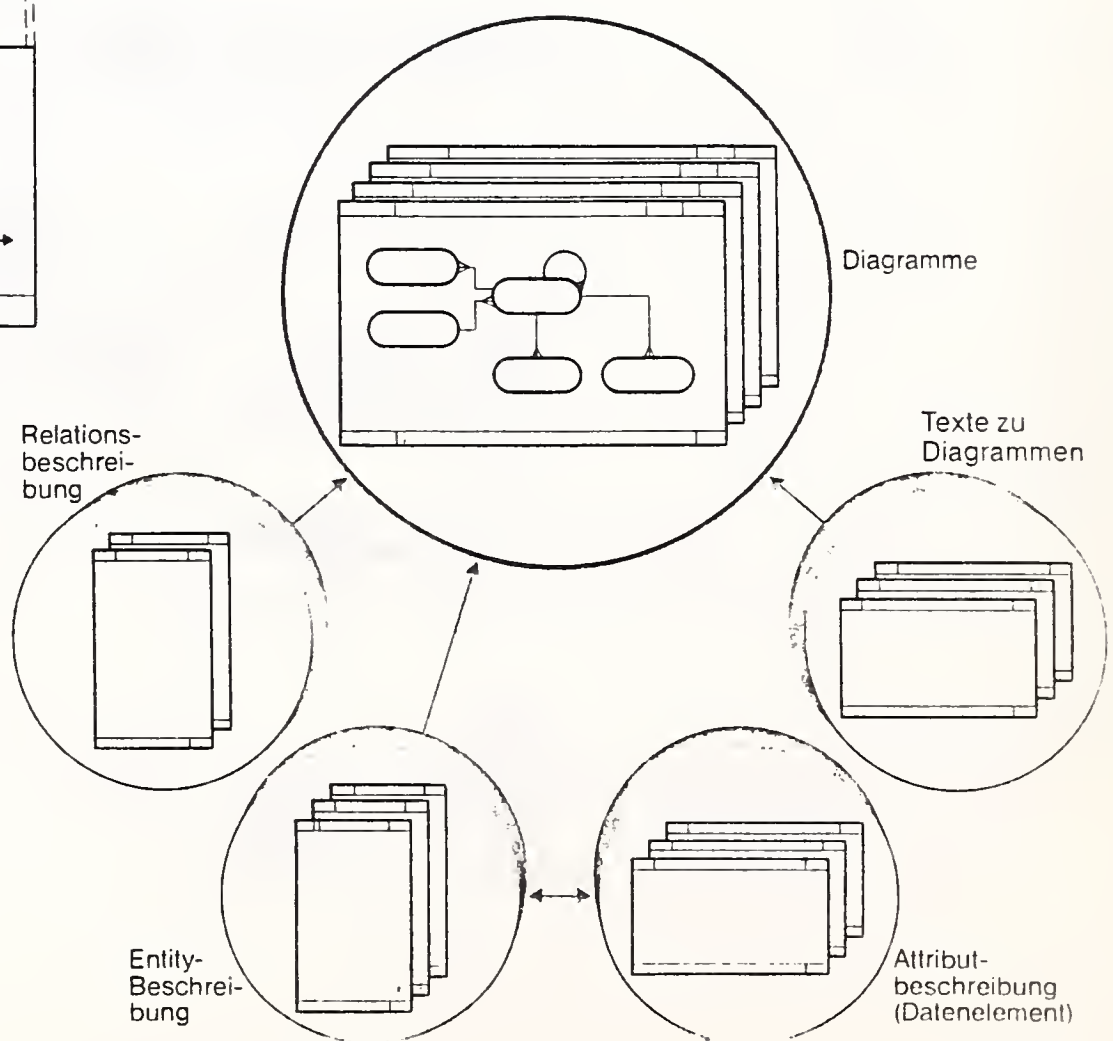
### Strukturierung der Funktionen

- Diagrammsprache
- Darstellung von Systembeziehungen
- Kontextabgrenzung
- Modellbildung
- Top-Down-Zerlegung



## DSA

### Strukturierung der Daten



### Entwurf

Die Ergebnisse der Analysephase werden aus System- und Software-Sicht zum System- und Programmentwurf transformiert. Der Einsatz der Prinzipien

- strukturiertes Design
- Information-Hiding
- Abstraktion
- Modularisierung

liefert bei der funktionsorientierten Vorgehensweise eine baumartige Aufgabenstruktur, die sich in Programme umsetzen läßt. Der Einsatz der **Entwurfs-Spezifikations-Sprache** ESS erlaubt die Abstraktion von Implementierungsdetails und fördert die sukzessive Zerlegung von Aufgaben in Teilaufgaben.

ESS schafft die Voraussetzungen, um auf möglichst hoher Ebene das Zusammenspiel von Moduln exakt beschreiben und einem Test zugänglich machen zu können. Ein in ESS geschriebener Entwurf liefert alle Informationen, die zur Entscheidung über eine Wiederverwendung bereits erstellter Module in zukünftigen Systemen notwendig sind.

Das Seminar „Entwurf“ vermittelt eine Einführung in die Technik des Entwurfes mit Hilfe von „ESS“.

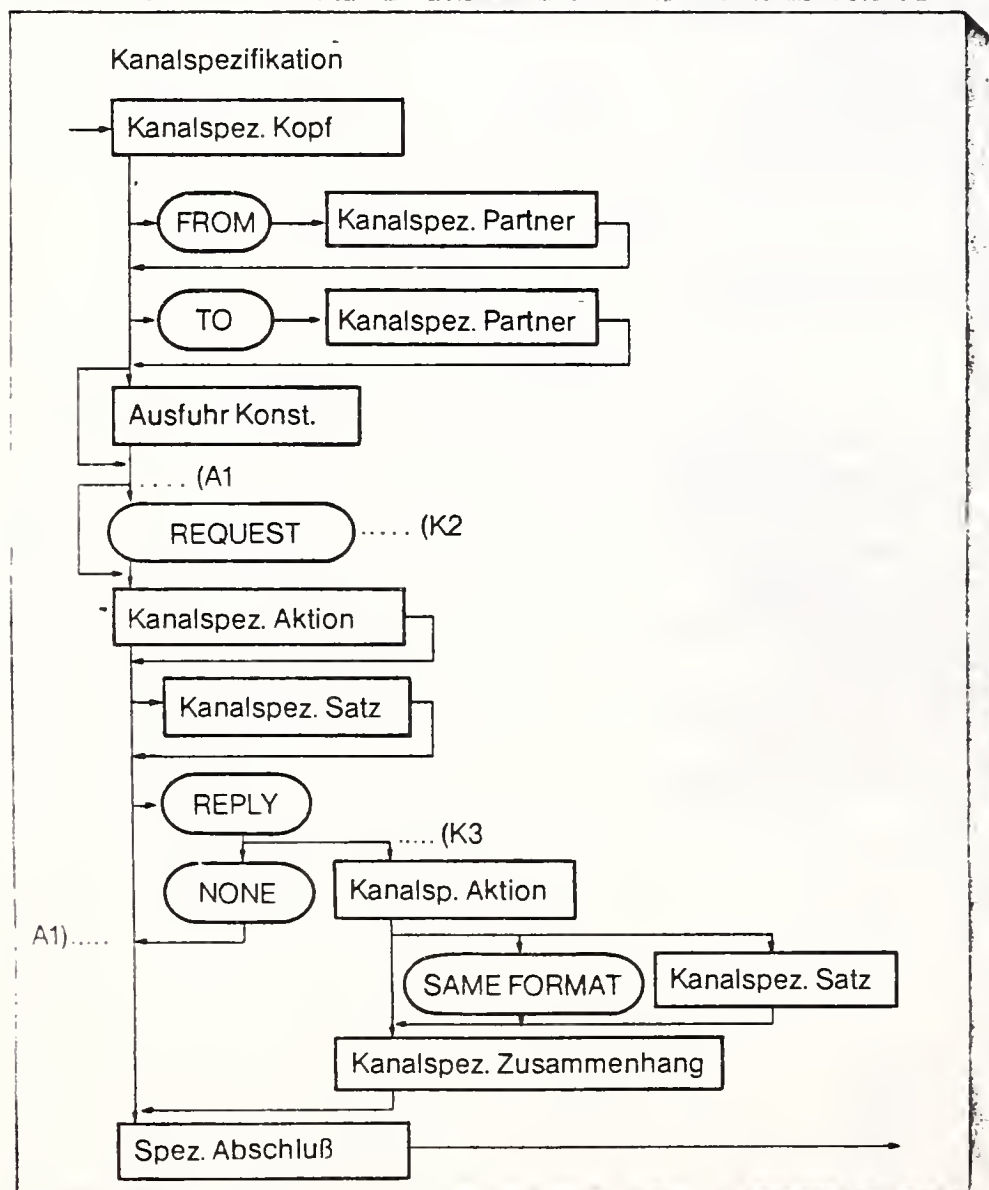
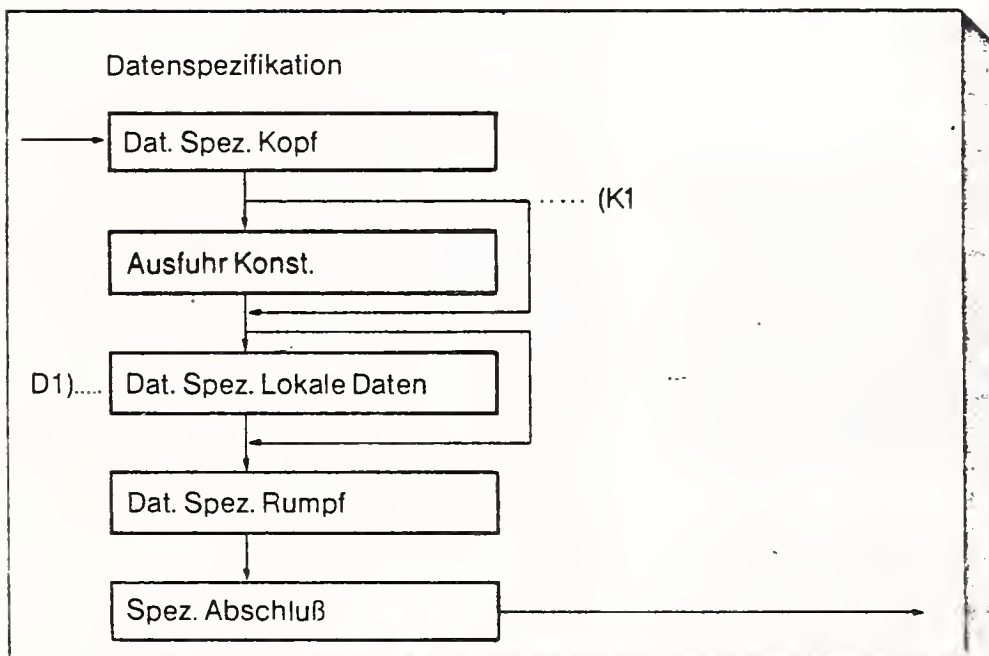
### Realisierung

Die Umsetzung der Modulspezifikation in Code geschieht über den Zwischenschritt des Pseudocodes, der als Kommentar in den späteren Quellen erhalten bleibt. Der von SCS eingesetzte pascal-ähnliche Pseudocode unterstützt die strukturierte Programmierung und erhöht die Lesbarkeit, die Wartbarkeit und die Portabilität der Software. Er erleichtert eine effiziente, komfortable Erstellung zuverlässiger Software.

### Integration und Test

Im Mittelpunkt dieser Phase steht die „fehlerfreie“ Integration der realisierten Moduln. Dabei ist die Funktionstüchtigkeit (black box test) und die Fehlerfreiheit (white box test) zu testen.

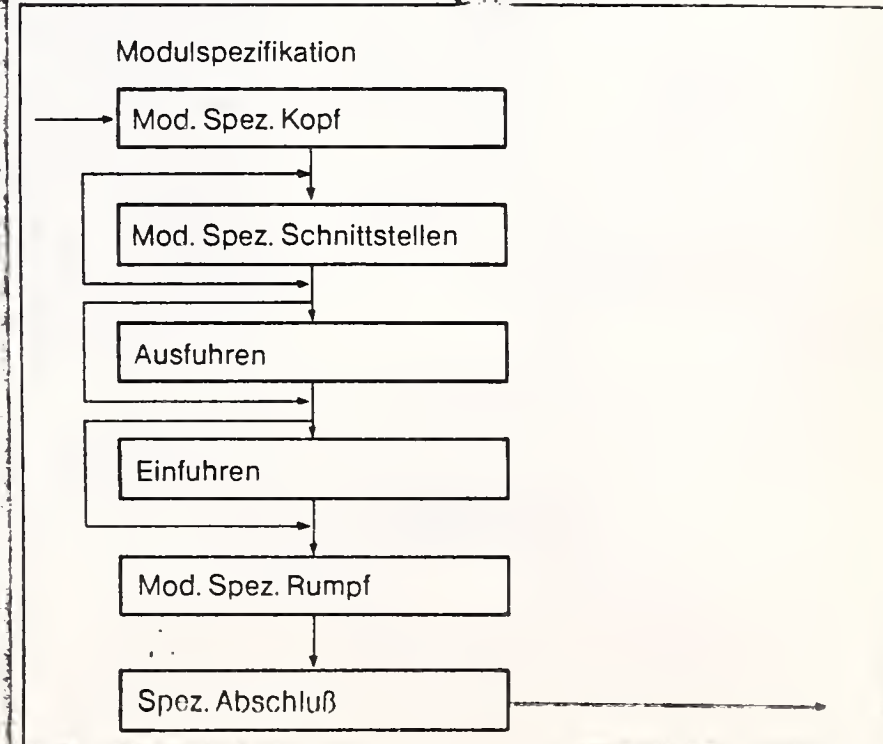
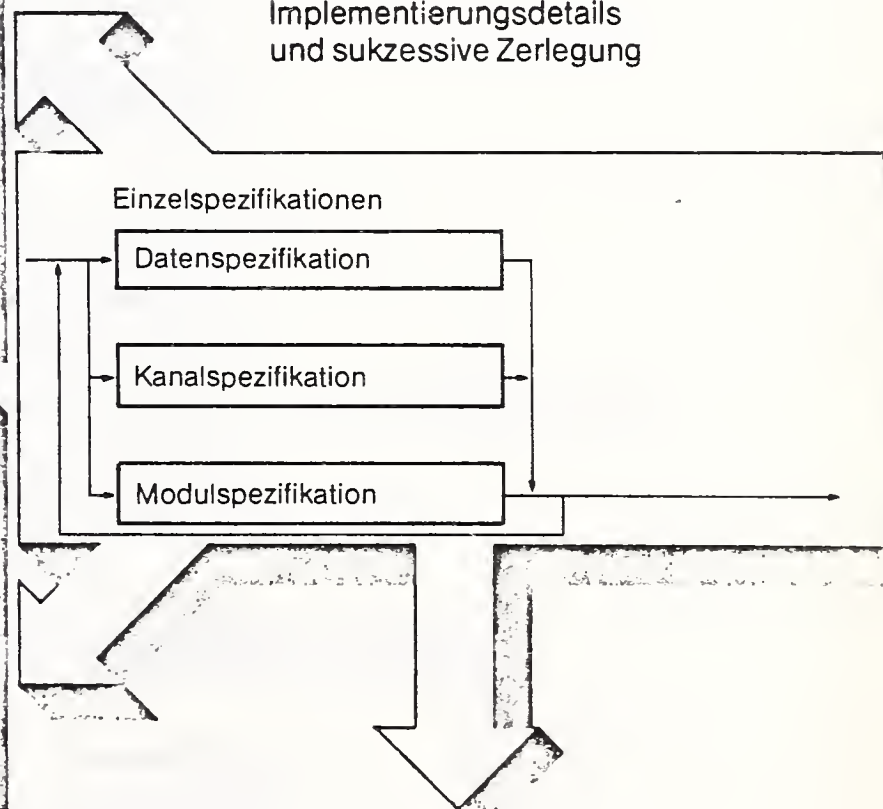
Die von SCS angewandte Methodik erfordert eine projektbegleitende Behandlung der Testproblematik. Dabei erfolgt die Testplanung und Festlegung der Teststrategie möglichst frühzeitig. Testelemente sind bereits in der Analysephase mit dem späteren Nutzer zu vereinbaren. Mit der Entwicklung der Software werden Testplan und Teststrategie weiter detailliert. Eine vollständige Testdokumentation sorgt für die Reproduzierbarkeit der Tests. Konfigurationskontrolle und Abnahmetests sichern die Funktionsfähigkeit von Moduln nach Änderungen.



## ESS

### Entwurfsspezifikation der Software

Abstraktion von  
Implementierungsdetails  
und sukzessive Zerlegung





# PRADOS – Projektmaschine

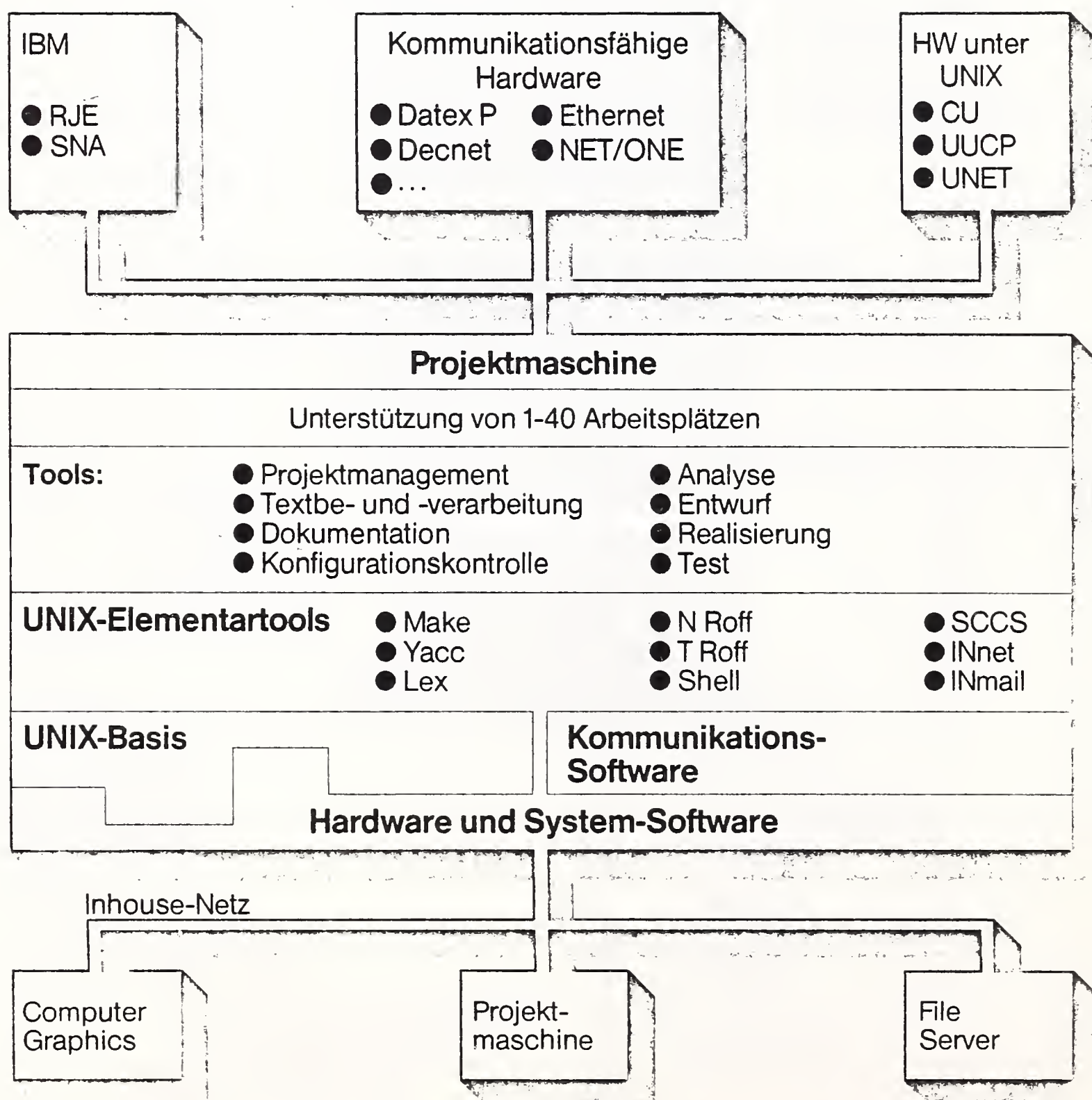
## **PRADOS-Projektmaschine – die zeitgemäße Lösung**

Die grundlegende Problematik der Software-Entwicklung ändert sich nicht durch den Einsatz neuer Hardwaregenerationen. Daher sollten die Investitionen in einen Entwicklungsarbeitsplatz auch bei einem Hardwarewechsel nicht verloren sein.

SCS hat als Grundlage der maschinellen Systemunterstützung für PRADOS (der Projektmaschine) das Betriebssystem UNIX gewählt, das als einziges auf nahezu jeder modernen Hardware verfügbar ist und sich als Weltstandard im Bereich der 16/32 bit Computer durchgesetzt hat. Darüber hinaus bietet UNIX selbst für die Software-Entwicklung wichtige Elementartools.

Diese Entscheidung erlaubt es, in einem weiten Bereich eine kostengünstige Unterstützung der Software-Entwicklungs-Arbeit unabhängig von der Zahl der zu unterstützenden Arbeitsplätze zu realisieren. Ob 4 oder 40 Arbeitsplätze, der Funktionsumfang ist gleich, die Hardware kann unter Nutzung preiswerter Mini- und Mikrocomputersysteme an die entsprechende Umgebung angepaßt werden.

Die so entstandene Unabhängigkeit ermöglicht es, die aus ergonomischen Gesichtspunkten günstigsten Arbeitsplatzgeräte einzusetzen. Jüngste Entwicklungen zeigen, daß der Trend, verstärkt intelligente Terminals zu nutzen, gerade auch bei der Software-Entwicklung von Bedeutung sein wird.



### **PRADOS-Software-Werkzeuge – die effektive, nutzerfreundliche Unterstützung**

Im Gegensatz zu vielen anderen Ansätzen wurden die PRADOS-Software-Werkzeuge auf der Basis eines Gesamtkonzeptes geschaffen. Das Design dieser Werkzeuge ist daher aufeinander abgestimmt. Konsequente Modularisierung und saubere Schnittstellen ermöglichen es, auch zukünftige Entwicklungen des Software-Engineerings zu berücksichtigen und mit Werkzeugen zu unterstützen.

Die Realisierung der Werkzeuge erfolgte nach den folgenden Leitlinien:

#### **● Unterstützung des gesamten Software-Life-Cycles**

Die PRADOS-Software-Werkzeuge realisieren die im PRADOS-Arbeits-system festgeschriebene Methodik.

Sie stellen eine Werkzeugbank dar, mit deren Hilfe

- das Projektmanagement
- die Qualitätssicherung
- die Konfigurationskontrolle
- die Dokumentation
- und die einzelnen Phasen der Software-Entwicklung

rationell und unter Einhaltung von Standards durchgeführt werden können.

#### **● Nutzerfreundlichkeit**

Die PRADOS-Software-Werkzeuge sind weitgehend selbstdokumentierend und minimieren dadurch den Schulungsaufwand. Mittel dazu sind:

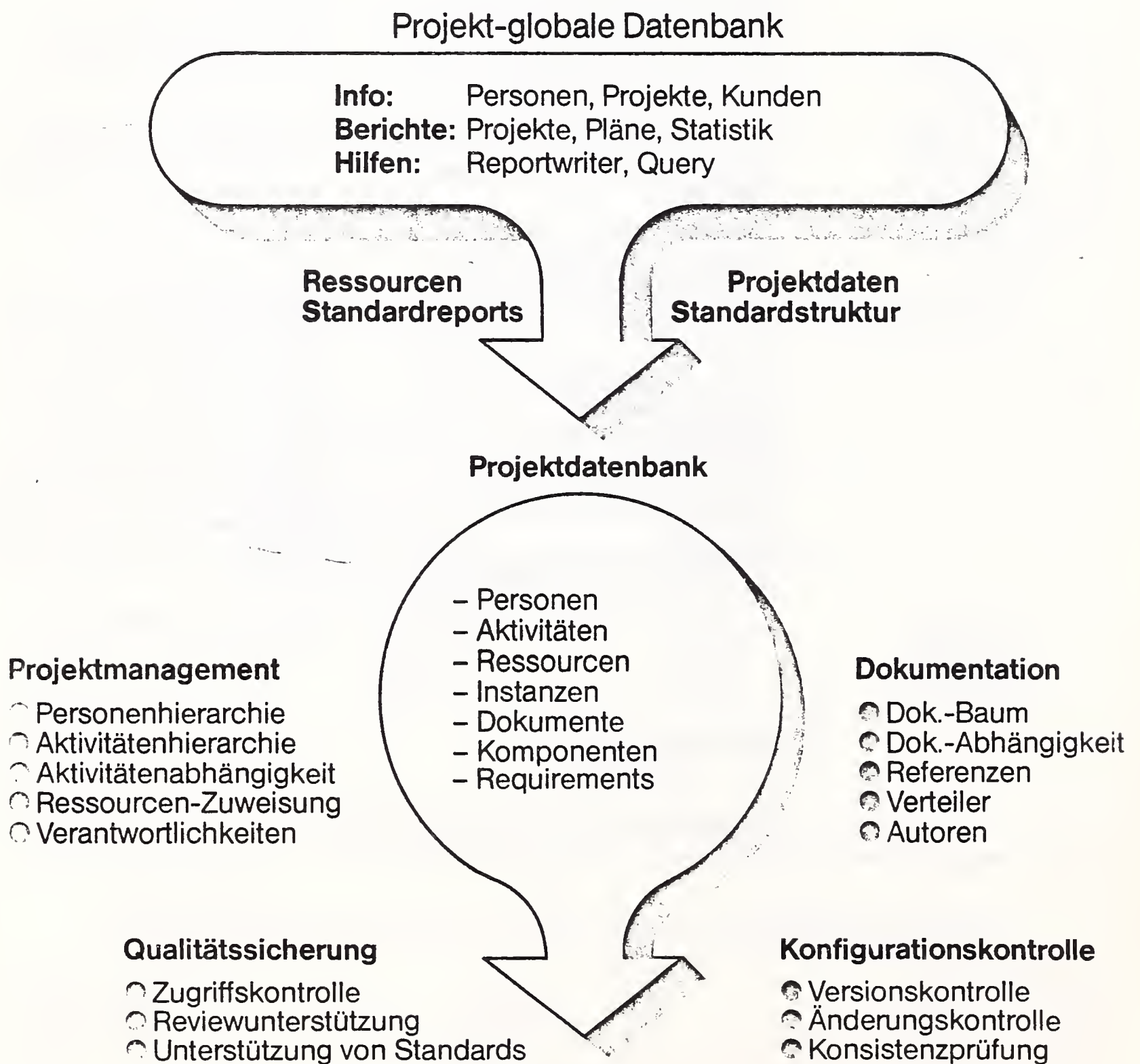
- Rechnerunterstütztes Lernen
- Help-Funktionen auf Kommando- und Menü-Ebene
- Online Manuals
- Integrierte Help-Funktionen bei interaktiven Programmen
- Menü-gesteuerte Nutzerführung.

Die Nutzerfreundlichkeit von PRADOS ist ein Beitrag zur schnellen Akzeptanz der Werkzeuge und fördert damit die rasche Rentabilität der Investitionen.

#### **● Integration der Werkzeuge**

Die PRADOS-Software-Werkzeuge besitzen eine innere und äußere Integration. Innere Integration bedeutet dabei, daß die Werkzeuge ohne zeit-aufwendige Konvertierung die notwendigen Daten erhalten. Mit äußerer Integration ist hier die Tatsache beschrieben, daß das äußere Erscheinungsbild der Werkzeuge, nämlich Masken, Help-Funktionen, Funktionsauswahl, Fehlermeldungen, Standardformate für alle Werkzeuge einheitlich ist.

## Tools für Querschnittsfunktionen





#### ● Konsistenz der Dokumentation

Zentrales Element von PRADOS ist ein Datenbanksystem. Diese Entscheidung berücksichtigt, daß bei der Software-Entwicklung zwischen mehreren Dokumenten und Informationen Relationen beschrieben werden müssen und die gespeicherten Dokumente vollständig und konsistent sein sollen. Als langfristiges „Gedächtnis“ im Entwicklungs- und Pflegeprozeß erlaubt es die Projektdatenbank, schon bei der Eingabe von Daten und Beschreibung Konsistenzprüfungen durchzuführen. Dabei sind Monologe (separat erstellte, lineare Beschreibungen) genauso berücksichtigt wie die interaktive Eingabe (Dialog).

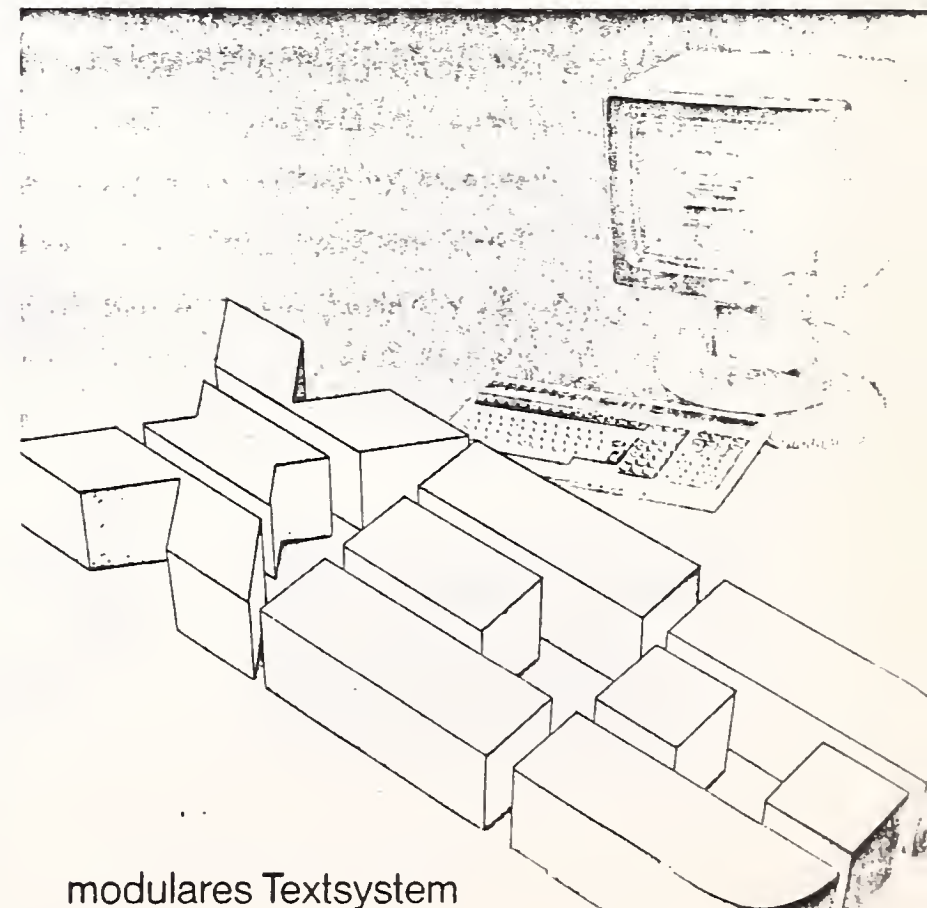
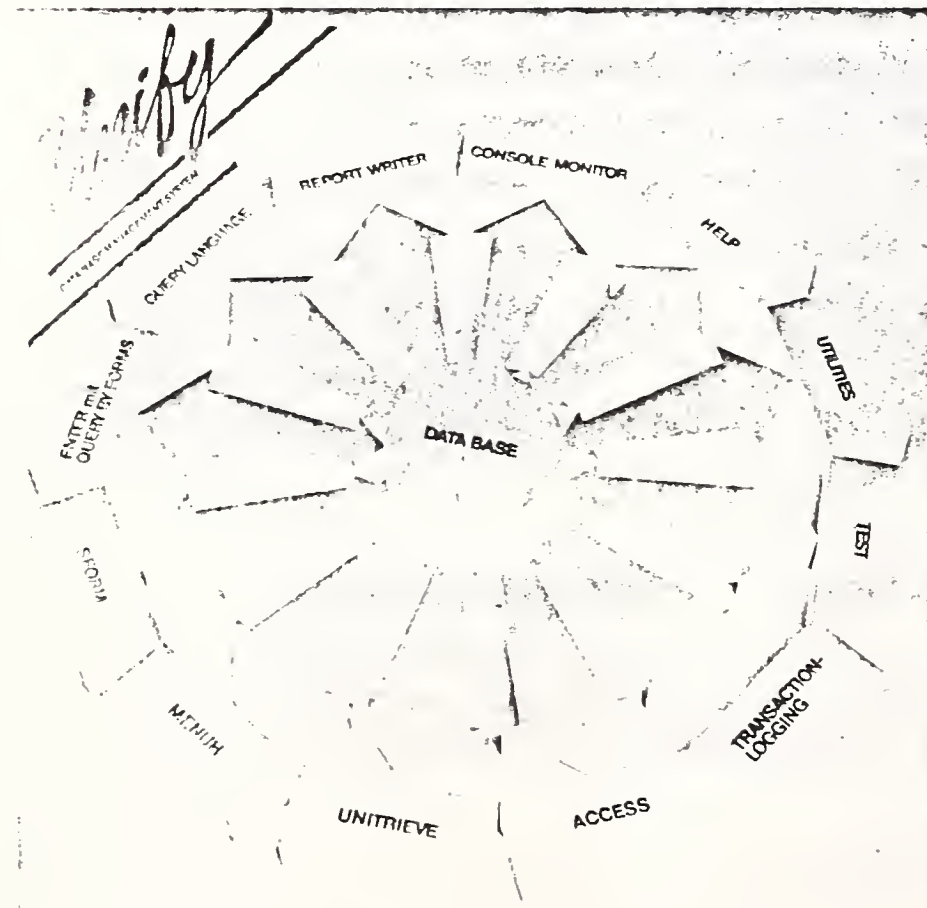
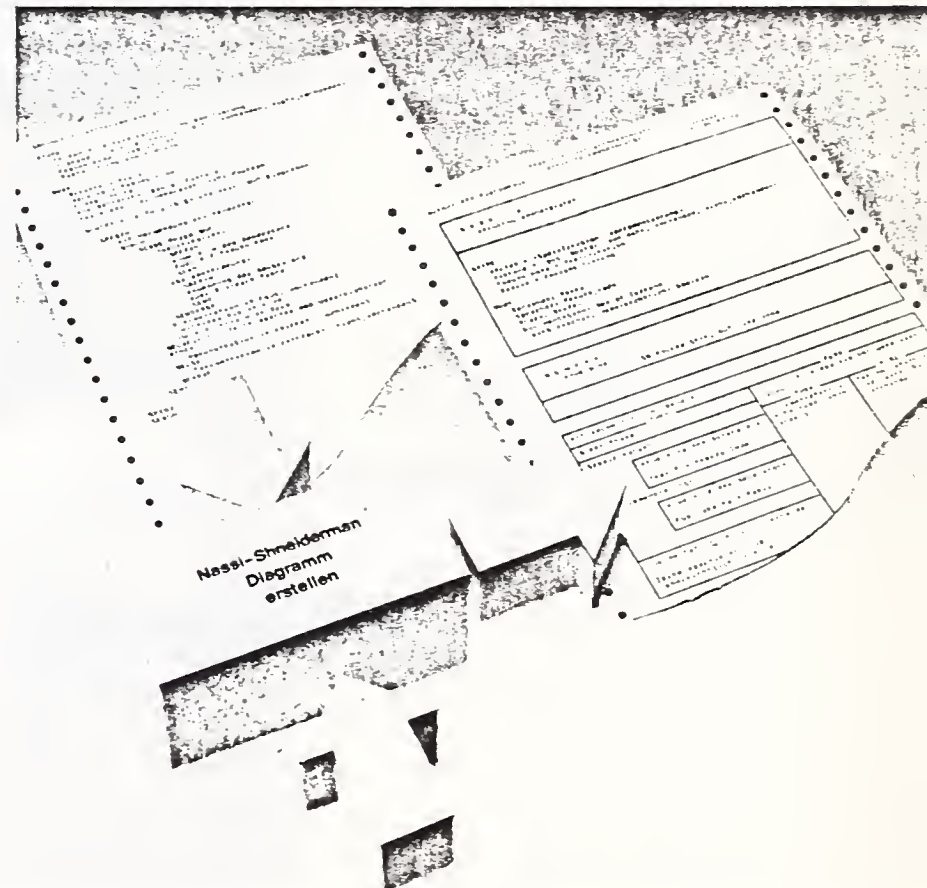
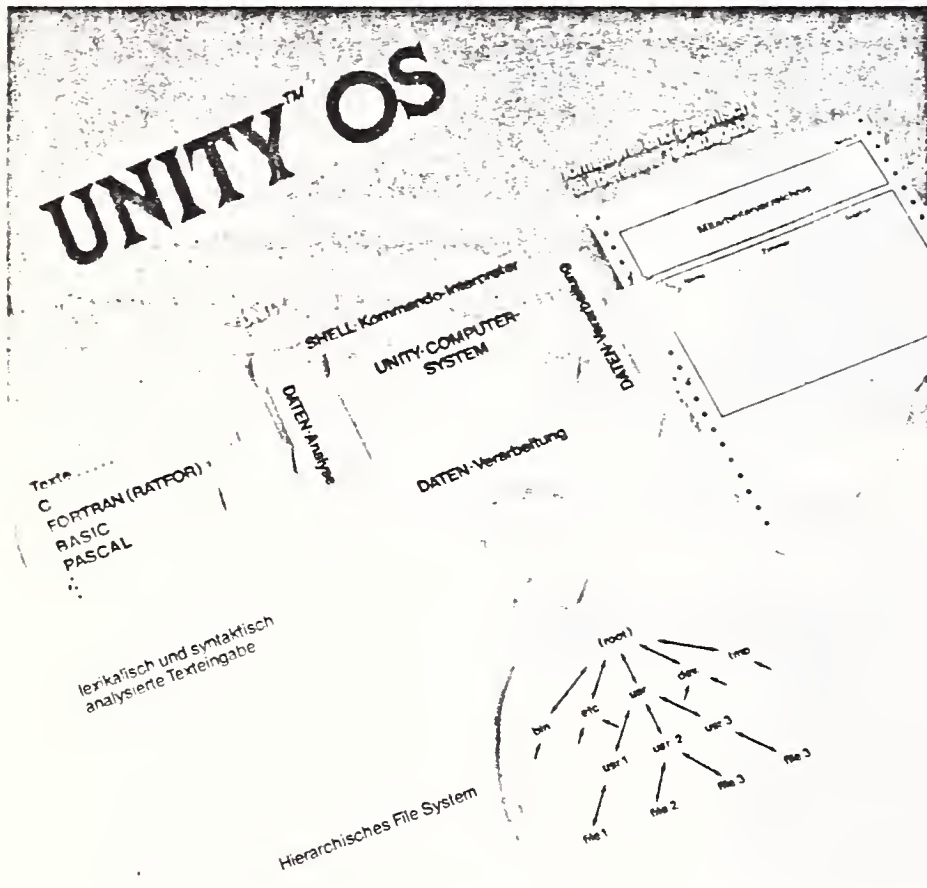
#### ● Effektivität der Werkzeuge

Funktionsumfang und Zusammenspiel der Werkzeuge sind im Hinblick auf Produktivitätssteigerung und weitgehende Automatisierung realisiert worden. Die Entlastung des Softwareentwicklers von Trivial- und Standardaufgaben durch Software-Werkzeuge schafft mehr Freiraum für die Lösung kreativer Aufgaben.

#### ● Anpassungsfähigkeit

Software-Entwicklung erfolgt stets unter nutzerspezifischen Randbedingungen. Eingeführte Verfahrensweisen, Methoden und Werkzeuge sind – soweit sie der PRADOS-Philosophie nicht widersprechen – in das System integrierbar. PRADOS ist damit ein offenes System.

Informationen über die einzelnen Werkzeuge sind in Form von Produktbeschreibungen erhältlich.



# PRADOS

## Schulung und Einführung

### **PRADOS – Schulungs- und Einführungs-konzept – Wirksame Hinführung zur methodischen Projektarbeit**

Methoden müssen durch Menschen in die Praxis umgesetzt werden. Vorgaben und Richtlinien allein helfen nicht. Eine motivierende Anleitung in Form von Schulungen hilft Anfangswiderstände zu überwinden, Verständnisfehler zu minimieren, Aufwand und Zeit zu sparen.

Der kritische DV-Profi will vom erfahrenen Fachmann die Frage nach dem konkreten Nutzen einer Methode für seine Arbeit beantwortet haben. In Seminaren und Workshops der SCS Akademie vermitteln erfahrene Trainer nicht Fachbuchwissen, sondern Projekt-Know-How.

Alle Seminare und Workshops sind von Fallbeispielen und Übungen durchsetzt. So übt der Seminarteilnehmer frühzeitig die Anwendung der neuen Methoden.

Die Rückkopplung aus Fragen und Anregungen aus früheren Seminaren führt zu einer stetigen Verbesserung der Qualität der Vermittlung. Ziel der Seminare und Workshops ist Wissen und Können zu vermitteln.

Alle Seminare werden in kleinen Gruppen, im allgemeinen nicht mehr als 12 Teilnehmern, abgehalten. Dies garantiert eine individuelle Beratung für jeden Teilnehmer. Wann immer möglich, treten neben dem Referenten auch weitere SCS-Professionals auf, die aus konkreter Projektarbeit und dem Einsatz der zu vermittelnden Methoden in ihren Projekten berichten.

Bei komplexen Projekten stellt SCS nach einem In-House-Seminar zu den Methoden auch Methodenberater zur Verfügung, die bei den ersten Versuchen, die neuen Methoden sachgerecht einzusetzen, helfen können.

Die Wirklichkeit ist sicher komplexer als die Fallbeispiele eines Workshops: ein Methodenberater (sei er von SCS oder vom Kunden) kann seine Erfahrungen in ein Projekt einbringen, um die Systemanalytiker in ihrem Können zu unterstützen.

Vom Projektteam in Zusammenarbeit aller Projektmitarbeiter entworfene Aktionspläne und Selbstkontrollmechanismen stellen den kombinierten Lernerfolg aus Seminar und Pilotprojekt sicher.

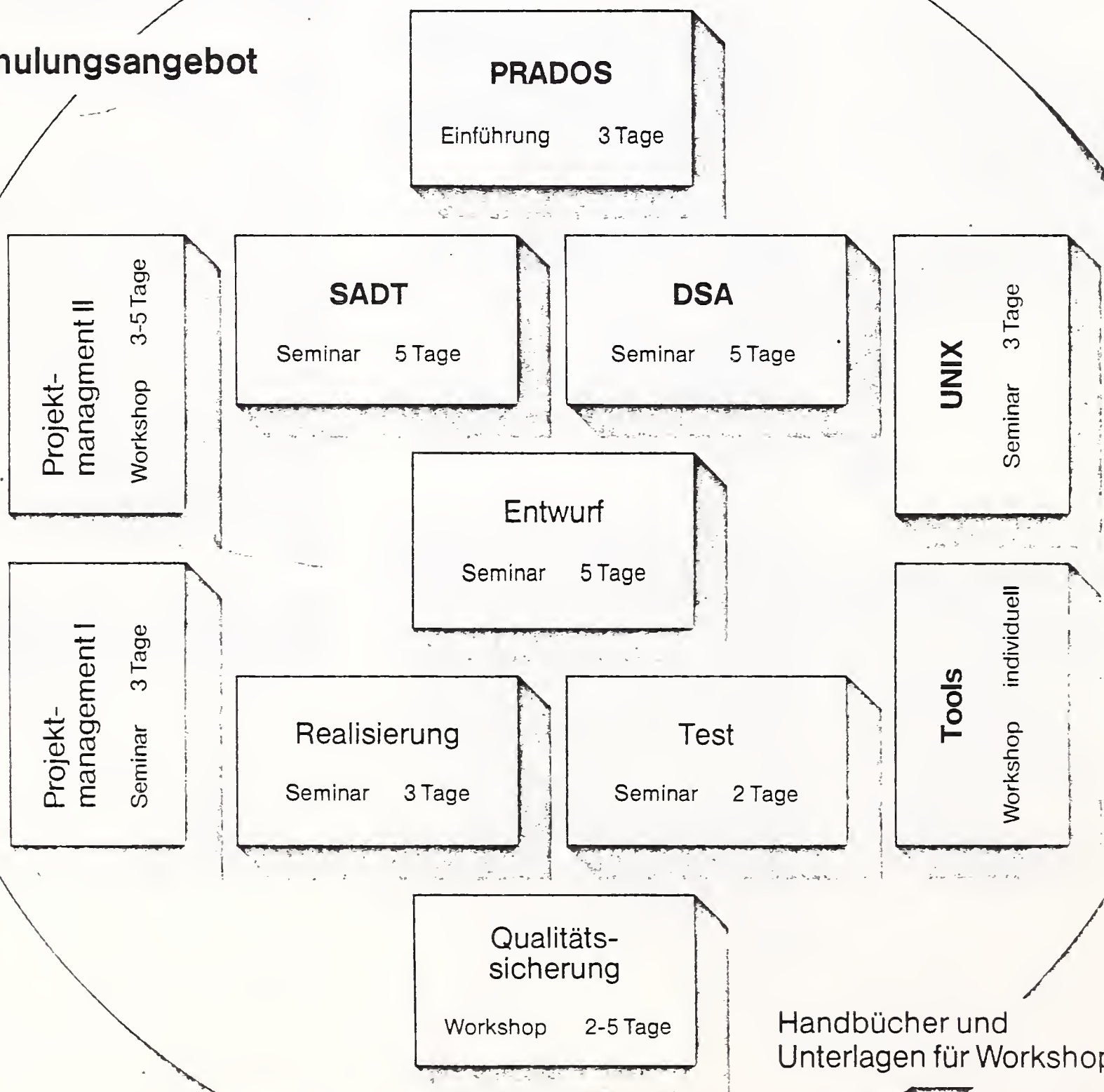
Die SCS Akademie schafft durch ihre Seminare und Workshops die Voraussetzungen dazu.

Alle Seminare sind modular aufgebaut und werden von langjährig erfahrenen SCS-Trainern und Professionals gehalten. Dies schafft die Möglichkeit, Seminare dem jeweiligen unternehmensspezifischen Ausbildungsstand und der jeweiligen Problemsituation anzupassen. Die SCS Akademie entwickelt auf Wunsch Ausbildungskonzepte, die die Unternehmenssituation bei der Einführung der Software-Methoden berücksichtigen. Die Abbildung zeigt einen Standardsatz von Seminaren. Zu allen Seminaren gibt es ausführliche Handbücher und Unterlagen. Kundenspezifische Fallbeispiele werden eingearbeitet.

**PRADOS-Seminare der SCS Akademie – die maßgeschneiderte Weiterbildung in Software-Engineering-Methoden.**



## Schulungsangebot





# SCS im Profil

Die SCS Scientific Control Systems GmbH wurde 1969 in Hamburg gegründet. SCS ist eine Tochter der Deutschen BP Aktiengesellschaft mit Schwestergesellschaften in England, Frankreich, Amerika und dem Mittleren Osten.

SCS ist das größte Beratungsunternehmen für Organisation, Automation und Datenverarbeitung in der Bundesrepublik Deutschland.

Die Tätigkeitspalette der SCS umfaßt:

Management-Beratung  
ORG/DV-Beratung  
Software-Systeme  
Technische Automation  
Systeme und Produkte  
Personalberatung  
Training

Für mehr als 500 Kunden aus privater Wirtschaft und öffentlicher Verwaltung hat SCS in über 1500 Projekten maßgeschneiderte Lösungen und Systeme konzipiert und realisiert, gemäß dem Grundsatz: Das Machbare denken – das Denkbare machen.

SCS-Geschäftsstellen in Hamburg, Essen, Köln, Frankfurt, Stuttgart und München gewährleisten eine kundennahe Durchführung der Projekte..

SCS-Kunden sind führende Unternehmen aus allen Bereichen der Industrie und des Dienstleistungssektors sowie zahlreiche Behörden und andere öffentliche Institutionen.

SCS wickelt jeden Auftrag in Form eines Projektes ab. Ein projektadäquates Team wird ausschließlich für dieses Projekt bereitgestellt und ein Projektleiter als verantwortlicher Gesprächspartner für den Kunden benannt.

SCS-Projekte umfassen alle Projektphasen von der Analyse über Konzeption und Realisierung bis zur Inbetriebnahme. Die Projektgrößen variieren von wenigen Mann-Monaten bis zu etlichen Mann-Jahren. Die Beauftragung von SCS kann hierbei auch phasenweise erfolgen. Als Vertragsarten stehen je nach Aufgabenstellung Dienst- und Werkverträge zur Wahl. SCS liefert DV-Systeme auch schlüsselfertig.

Gründliche Ausbildung, praktische Erfahrung und persönliches Profil der SCS-Mitarbeiter bilden eine entscheidende Voraussetzung für das Niveau des Leistungsangebotes der SCS.

SCS-Mitarbeiter verfügen im Durchschnitt über 10 Jahre Berufserfahrung und besitzen überwiegend einen Hochschulabschluß. Ihr Ausbildungs- und Erfahrungsspektrum ist weit gefächert: Ingenieure, Volks- und Betriebswirte, Physiker, Mathematiker, Informatiker und andere Fachausbildungen verbinden sich mit praktischen Erfahrungen bei Wirtschaftsunternehmen und Behörden.

Umfangreiches Anwendungs-Know-how, erfahrene Mitarbeiter mit einem breiten Ausbildungsspektrum und erprobte Methoden des Projektmanagements und der Projektdurchführung stellen die qualitative und wirtschaftliche Lösung der Aufgaben sicher.

SCS legt Wert auf eine enge Zusammenarbeit mit dem Kunden. Dadurch wird auch sichergestellt, daß die gemeinsam erarbeiteten Lösungen von allen Beteiligten getragen werden. Die problemlose Einführung und der zukunftsichernde Nutzen sind damit gewährleistet.

<p><b>Geschäftssitz</b>  <b>SCS Scientific Control Systems GmbH</b>  Oehleckerring 40 - 2000 Hamburg 62 - Postfach 62 04 80  Telefon: 040/5 31 03-0 - Telex: 2 174 113 - Telefax: 040/5 31 03-574</p>	
<p><b>Geschäftsstelle Zentrale Projekte</b>  Technische Beratung und Automation  Oehleckerring 40 - 2000 Hamburg 62  Tel.: 040/5 31 03-0 - Telex: 2 174 113  Telefax: 040/5 31 03-574</p>	<p><b>SCS Akademie</b>  Oehleckerring 40 - 2000 Hamburg 62  Tel.: 040/5 31 03-246 - Telex: 2 174 113  Telefax: 040/5 31 03-574</p>
<p><b>Geschäftsstelle Hamburg</b>  Unternehmensberatung  Oehleckerring 40 - 2000 Hamburg 62  Tel.: 040/5 31 03-0 - Telex: 2 174 113  Telefax: 040/5 31 03-574</p>	<p><b>SCS Systemhaus</b>  Stuntzstraße 16 - 8000 München 80  Tel.: 089/470 50 74 - Telex: 5 24 419</p>
<p><b>Geschäftsstelle Essen</b>  Unternehmensberatung  Ill. Hagen 43 - 4300 Essen 1  Tel.: 0201/23 30 91 - Telex: 8 579 738  Telefax: 0201/23 30 91-215</p>	<p><b>SCS Personalberatung</b>  Johnsallee 13 - 2000 <b>Hamburg</b> 13  Tel.: 040/44 16 51 - Telex: 2 164 277</p>
<p><b>Geschäftsstelle Essen</b>  Technische Beratung und Automation  Ill. Hagen 43 - 4300 Essen 1  Tel.: 0201/23 30 91 - Telex: 8 579 738  Telefax: 0201/23 30 91-215</p>	<p>Bahnhofstraße 1-9 - 5000 <b>Köln</b> 1  Tel.: 0221/12 03 53 - Telex: 8 883 387</p>
<p><b>Geschäftsstelle Frankfurt</b>  Unternehmensberatung und Automation  Mainzer Landstr. 46-6000 <b>Frankfurt/M.</b> 1  Tel.: 0611/71 01-0 - Telex: 4 11 002  Telefax: 0611/71 01-160</p>	<p>Mainzer Landstr. 46 - 6000 <b>Frankfurt/M.</b> 1  Tel.: 0611/71 01-200 - Telex: 4 11 002  Telefax: 0611/71 01-160</p>
<p><b>Geschäftsstelle Stuttgart</b>  Unternehmensberatung und Automation  Breitwiesenstraße 27 - 7000 <b>Stuttgart</b> 80  Tel.: 0711/78 70-0 - Telex: 7 255 867  Telefax: 0711/78 70-106</p>	<p>Breitwiesenstraße 27 - 7000 <b>Stuttgart</b> 80  Tel.: 0711/78 70-200 - Telex: 7 255 867  Telefax: 0711/78 70-106</p>
<p><b>Geschäftsstelle München</b>  Unternehmensberatung und Automation  Leopoldstraße 139-145 - 8000 <b>München</b> 40  Tel.: 089/3 60 08-0 - Telex: 5 24 971  Telefax: 089/3 60 08-103</p>	<p>Leopoldstraße 139-145 - 8000 <b>München</b> 40  Tel.: 089/3 60 08-200 - Telex: 5 24 971  Telefax: 089/3 60 08-103</p>
	<p><b>SCS Management Consultants GmbH</b>  Magdalenenstraße 1 - 2000 Hamburg 13  Tel.: 040/44 79 51-53 - Telex: 2 164 277</p>
	<p><b>PPU Peifer &amp; Partner</b>  Unternehmensberatung GmbH  Leopoldstraße 139-145 - 8000 <b>München</b> 40  Tel.: 089/3 60 08-300 - Telex: 5 24 971  Telefax: 089/3 60 08-103</p>
	<p><b>TELEDAT</b>  Datenverarbeitungs GmbH  Leopoldstraße 139-145 - 8000 <b>München</b> 40  Tel.: 089/3 60 08-300 - Telex: 5 24 971  Telefax: 089/3 60 08-103</p>

C. CODATA SYSTEM 3300

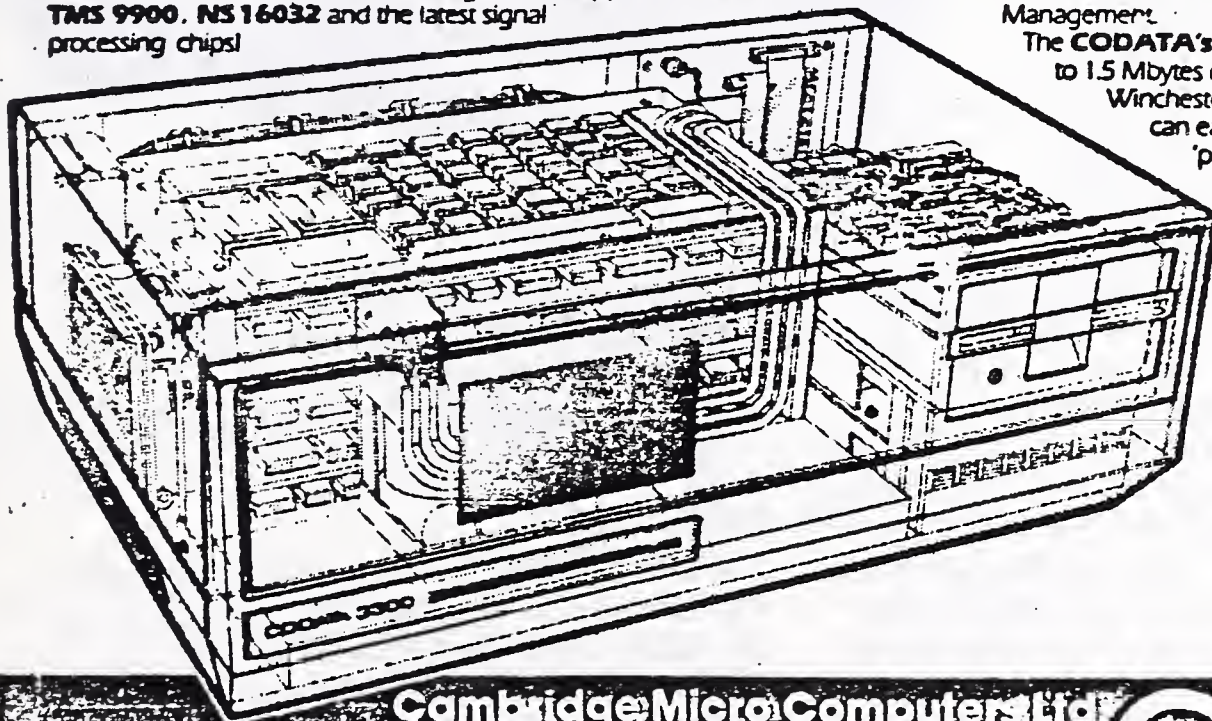




# CODATA 3300

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Save programmer's time! Develop software under multi-user **UNIX** on the high performance **CODATA 3300**. Our range of cross compilers allow efficient code to be targeted to **8080, Z80, 8085, 8086, 6502, 6809, TMS 7000** and others. Coming soon is support for **Z8000, TMS 9900, NS 16032** and the latest signal processing chips!



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Systems International February 1984



# CODATA 3300™

The CODATA 3300 is a powerful 16-bit, 68000-based, MULTIBUS™ system that can effectively accommodate ten or more users. It's a complete UNIX™ system that runs full ANSI standard FORTRAN-77, RM/COBOL, BASIC +, SMC BASIC, APL, and PASCAL. The 3300 provides a choice of 12, 33, or 84

megabytes of unformatted on-line storage (10, 26, or 68 megabytes formatted) via high-speed Winchester disk drive, and a quad-density 5¼" floppy disk system. The 3300 features 320K bytes of parity protected RAM, expandable to 1.5 megabytes.

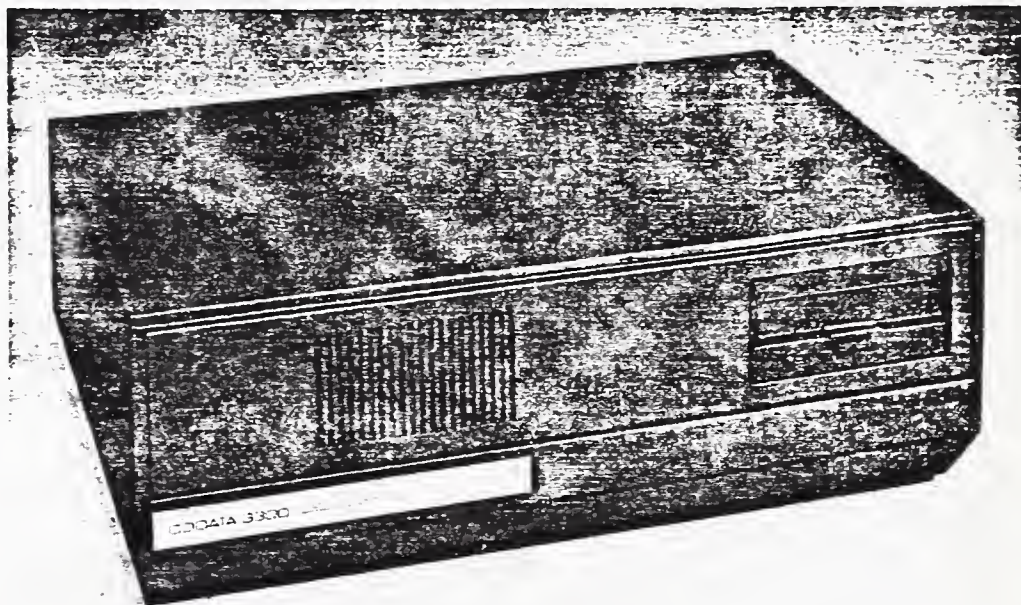
## HARDWARE

The Codata 3300 is designed for both flexibility and performance. It is a multiprocessor system with the main peripherals containing processing elements designed to relieve the central processing unit of the detailed I/O operations.

The Codata 3300 features two serial ports tied directly to the central processor board. Two intelligent serial controllers may be added to the system. These controllers permit operation on eight ports each. Individual port speeds can be adjusted from 50 to 19,200 baud. Terminals, printers, and other serial peripherals can be interfaced to the system through the I/O ports. Disk storage is available in an integral 12 or 33 megabyte Winchester disk. The optional 84 megabyte disk is stored in a separate enclosure. The 33 and 84 megabyte disks feature a voice coil design for fast access time and increased system performance. All of these disks may easily be upgraded with another disk of the same size. For those customers who wish to interface their own disk drive, the Codata 3300 is available with an SMD disk controller only.

## OPTIONS

- Additional Serial Ports. The Codata 3300 can accommodate two octal serial I/O cards for a total of 18 serial ports.
- Additional Disks. Up to three additional Winchester disk drives may be added to the system. Add-on drives must be the same capacity as the primary disk drive.
- Cartridge Tape Unit. Capable of storing 10 megabytes of data on a DC300 tape cartridge.



- Magnetic Tape Unit. Industry standard nine-track, dual-density 800/1600 BPI, magnetic tape system.
- Memory. 320K bytes standard may be upgraded to 1.5 megabytes.

## SOFTWARE

UNISIS™, Codata's version of Bell Laboratories UNIX V-7, is the operating system for the 3300. UNISIS is delivered with the "C" compiler. Program development is available in other popular programming languages including FORTRAN, PASCAL, COBOL, BASIC, and APL.

## SPECIFICATIONS

SIZE:	Width	— 22"
	Height	— 8"
	Depth	—14.5"
WEIGHT:	38 lbs.	—system unit
POWER:	115 VAC	60Hz 2.5 Amps
	230 VAC	50Hz 1.25 Amps
ENVIRONMENTAL:	10-40 degrees C operating range 20%- 80% relative humidity (non-condensing)	

## CODATA SYSTEMS CORPORATION

285 North Wolfe Road, Sunnyvale, CA 94086  
(408) 735-1744, 1-800-521-6543  
In California: 1-800-221-2265

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SMC BASIC is a trademark of SMC.  
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## CAMBRIDGE MICRO COMPUTERS LIMITED

## MICROCOMPUTER PRICE LIST

JANUARY 1984

CAMBRIDGE MICRO COMPUTERS LIMITED

Science Park

Milton Road

Cambridge CB4 4BN

Telephone: Cambridge 314666

PRICES: POUNDS STERLING, EXCLUSIVE OF VAT  
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NOTE: Prices of Imported Equipment are computed on basis of Exchange Rate of £ = \$1.45. Should Exchange Rate vary by more than 2% at time of delivery a currency surcharge will be applied.

SECTION ONE: CODATA 3300  
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PART NO. -----	DESCRIPTION -----	PRICE. -----
SYS 0120-2	M68000, 256K CPU RAM, 64K Multibus RAM, 2 serial ports 10MB Winchester, 1MB Floppy 8 slot card-cage	£7990.00
SYS 0120-10	M68000, 256K CPU RAM, 64K Multibus RAM, 10 serial ports, 10MB Winchester, 1MB Floppy, 8 slot card cage.	£9300.00
SYS 0330-2	M68000, 256K CPU RAM, 64K Multibus RAM, 2 serial ports, 33MB Winchester, 1MB Floppy, 8 slot card cage	£9190.00
SYS 0330-10	M68000, 256K CPU RAM 64K Multibus RAM, 10 serial ports, with Intelligent I/O Controller, 33MB Winchester, 1MB Floppy, 8 slot card cage.	£10440.00
SYS 0840-10	M68000, 256K CPU RAM 64K Multibus RAM, 10 Serial I/O ports with Intelligent I/O controller, 84MB Winchester, 1MB Floppy, 8 slot card cage	£14240.00
SYS 0120-512-2	M68000, 256K CPU RAM, 512K Multibus RAM, 2 serial I/O ports 10MB Winchester, 1MB floppy, 8 slot card cage.	£ 9965.00

SYS 0330-256-10	M68000, 256K CPU RAM, 256K Fast RAM, 64K Multibus RAM, 10 serial I/O ports, 33MB Winchester, 1MB Floppy, 8 slot card cage.	£11248.00
SYS 0330-512-10	M68000, 256K CPU RAM, 512K Multibus RAM, 10 serial ports with Intelligent I/O controller, 33MB Winchester, 1MB Floppy, 8 slot card cage	£11865.00
SYS 0840-512-10	M68000, 256K CPU RAM, 512K Multibus RAM, 10 Serial ports with Intelligent I/O controller, 84MB Winchester 1MB Floppy, 8 slot card cage.	£15665.00
SYS 0840-512-T-10	M68000 256K CPU RAM 512K Multibus RAM 10 serial ports with Intelligent I/O Controller, 84MB Winchester, 1MB Floppy, Cartridge Tape, 8 slot card cage	£18365.00
SYS 0840-1024-10	M68000, 256K CPU RAM, 1024K Multibus Ram, 10 serial ports with intelligent I/O controller, 84MB Winchester, 1MB Floppy, 8 slot card cage.	£17090.00

SECTION TWO CTW300

PART NO. -----	DESCRIPTION -----	PRICE -----
		£10290.00
CTW300-64K-2W10F	M68000, 256K CPU RAM, 64K multibus RAM, 2x10MB Winchesters, 10 serial ports, 1MB Floppy, 9-slot card cage.	
CTW300-64K-W33-F	M68000, 256K CPU RAM, 64K Multibus RAM, 33MB Winchester, 10 serial ports, 1MB Floppy, 9-slot card cage.	£11290.00
CTW300-512K-2W10-F	M68000, 256K CPU RAM, 512K Multibus RAM 2x10MB Winchesters, 10 serial ports, 1MB Floppy, 9-slot card cage.	£11790.00



CTW300-512K-W33-F	M68000, 256K CPU RAM, 512K Multibus RAM 33MB Winchester, 10 serial ports, 1MB Floppy, 9-slot card cage.	£12790.00
CTW300-512K-W33-FT	M68000, 256K CPU RAM, 512K Multibus RAM 33MB Winchester, 10 serial ports, 1MB Floppy, Cartridge Tape, 9-slot card cage.	£15632.00
CTW300-512K-2W33-FT	M68000, 256K CPU RAM, 512K Multibus RAM, 2x33MB Winchesters, 10 serial ports, 1MB Floppy, Cartridge Tape, 9-slot card cage	£18732.00
CTW300-512K-W80-F	M68000, 256K CPU RAM, 512K Multibus RAM, 84MB Winchester, 10 serial ports, 1MB Floppy, Intelligent I/O controller, 9-slot card cage	£16990.00
CTW300-1024K-W80F	M68000, 256K CPU RAM, 1024K Multibus RAM, 84MB Winchester, 10 serial ports, 1MB Floppy, Intelligent I/O controller, 9 slot card cage.	£18490.00
CTW300-512K-W80-FT	M68000, 256K CPU RAM, 512K multibus RAM, 84MB Winchester, 10 serial ports, 1MB Floppy, Cartridge Tape, Intelligent I/O controller, 9-slot card cage	£19832.00
CTW300-1024K-W80-FT	M68000, 256K CPU RAM, 1024K Multibus RAM, 84MB Winchester, 10 serial ports, 1MB Floppy, Cartridge Tape, Intelligent I/O controller, 9-slot card cage.	£21332.00
CTW300-512K-W80-FM	M68000, 256K CPU RAM, 512K Multibus RAM, 84MB Winchester, 10 serial ports, 1MB Floppy, 9-track Magnetic Tape, Intelligent I/O controller, 9-slot card cage	£25490.00
CTW300-512K-2W80-FT	M68000, 256K CPU RAM 512K Multibus RAM, 2x84MB Winchesters, 10 serial ports, 1MB Floppy, Cartridge Tape, Intelligent I/O controller 9-slot card cage.	£24832.00

### SECTION THREE      UNIX WORK STATION

UWS-300-1024K-W80-F	WORK STATION, comprising System desk, with integral 19 inch rack, M68000, 256K CPU RAM, 1024K Multibus RAM, 10 serial ports, 84MB Winchester, 1MB Floppy, Intelligent I/O Controller, 9 slot card cage.	£19490.00
UWS-300-1024K-W80-FT	WORK STATION, comprising System desk, with integral 19 inch rack, M68000, 256K CPU RAM, 1024K Multibus RAM, 10 serial ports, 84MB Winchester, 1MB Floppy, Intelligent I/O Controller, 9 slot card cage.	£22332.00
UWS-300-1024K-W80-FM	WORK STATION, comprising System desk, with integral 19 inch rack, M68000, 256K CPU RAM, 1024K Multibus RAM, 10 serial ports, 84MB Winchester, 1MB Floppy, Intelligent I/O Controller, 9 slot card cage, 9-track Magnetic tape.	£26490.00

### SECTION FOUR

#### CIFER

MODEL 1887/10 with 10MB Winchester, 256K RAM, 68000 Processor and UNIX (SINGLE USER)	£ 4990.00
MODEL 1887/21 with 21MB Winchester, 256K RAM, 68000 Processor and UNIX (SINGLE USER)	£ 5490.00
MODEL 9032 with 10MB Winchester, 256K RAM, 68000 Processor and UNIX (SINGLE USER)	£ 3990.00
MODEL 9033 with 21MB Winchester, 256K RAM, 68000 Processor and UNIX (SINGLE USER)	£ 4490.00
MODEL 9033/512 with 21MB Winchester, 512K RAM, 68000 Processor and UNIX (SINGLE USER)	£ 5440.00
MODEL 9042 with 10MB Winchester (Fixed) 5MB exchangeable Winchester, 68000 Processor, 512K RAM & UNIX	£ 5495.00
MODEL 9043 with 21MB Winchester (Fixed) 5MB exchangeable Winchester, 68000 Processor, 512K RAM & UNIX	£ 5995.00
GRAPHICS OPTION	£ 320.00
FORTRAN 77	£ 500.00
PASCAL (SVS)	£ 500.00
BASIC-PLUS	£ 400.00

## SECTION FIVE

## HARDWARE OPTIONS AND BOARDS

## PRICE

256K RAM Card (CPU bus, No wait states)	£ 850.00
512K Multibus RAM Card	£1575.00
M68000 CPU Board (with 256K RAM)	£1775.00
ST 506 Winchester Disk Controller Board	£1606.00
SMD Drive Controller Board	£1639.00
Floppy Disk Controller Board	£ 503.00
Cartridge Tape Controller Board	£1366.00
9-Track Magnetic Tape Controller Board	£3355.00
Intelligent I/O Controller Board (8xRS232)	£1620.00
1MB Floppy Disk Drive (5 1/4 inch)	£ 450.00
1MB 8 Inch Floppy disk drive (in separate enclosure with P.S.U.)	£1250.00
10MB Winchester Disk Drive (Add-on, with cabinet)	£1650.00
33MB Winchester Disk Drive (Add-on, with cabinet)	£4350.00
84MB Winchester Disk Drive (inclusive of cabinet, power supply)	£7500.00
9 track Tape Sub-System (including Controller, 9 track Mag-tape drive & enclosure)	£ 8500.00
Cartridge Tape System (including controller and Cables and cabinet)	£2842.00
Colour Graphics Board (high Resolution with 512KB video memory arranged as 4 1024 x 1024 bit planes and 640 x 480 display format)	£2730.00
Colour Monitor High Resolution, Mitsubishi Model 6419	£1790.00
Graphic Software - GKS	T.B.A.
Floating Point Hardware, inc. Fortran and Pascal support	£2945.00

## ETHERNET

ETHERNET SYSTEM FOR CODATA (includes Ethernet Controller, Transceiver cable & Fusion Ethernet Software)	£2500.00 (per computer)
ETHERNET SYSTEM FOR IBM PC (includes Ethernet Controller & Fusion Ethernet software & Transceiver)	£1500.00 (per computer)
ETHERNET SYSTEM for VAX/UNIX (includes Ethernet controller & Fusion Ethernet software, Transceiver & Transceiver Cable)	£5000.00 (per computer)
ETHERNET COAXIAL CABLE	£ 2.30 per metre



SECTION SIX  
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SOFTWARE  
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UNISIS	UNISIS operating system, including UNIX version 7.0, with Berkeley enhancements, C Compiler and 68000 Assembler	£ 995.00
UNIX Reconfiguration Package		£ 500.00
UNISIS Manuals	Additional Copies	£ 180.00
FORTRAN 77	FORTRAN 77 Compiler	£ 366.00
PASCAL	PASCAL Compiler	£ 366.00
BASIC-PLUS	BASIC Interpreter	£ 366.00
SMC BASIC	BASIC Interpreter	£1050.00
MODULA -2	Modula -2 Compiler	£ 595.00
RM/COBOL Development	COBOL Compiler, Software development	£1120.00
RM/COBOL	COBOL Run-time software	£ 610.00
APL 68000	APL Interpreter	£1800.00
LISP	Lisp Interpreter	£1200.00
ADA	ADA compiler(University of California at Irvine)	£3500.00
HORIZON	Word Processor Package	£ 585.00
UNICALC	Spread Sheet Package	£ 366.00
UNIPLEX-WP	Word Processor Package	£ 575.00
Graphics	GKS Colour Graphics Software	T.B.A.
Rootmap	Menu System	£ 495.00
GINO-F	Graphics Subroutine Library	£1000.00
UNIFY	DATABASE Management Package	£2250.00

WHITESMITHS CROSS SOFTWARE  
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C Cross Compiler targetting to 8080/Z80 or 6809 68000 (includes Whitesmiths C native compiler, cross compiler, cross-assembler & all library utilities)	Price per target processor	£ 945.00
C Cross Compiler targetting to 6502		£1500.00
C Cross Compiler targetting to 8086		£1500.00
PASCAL cross compiler targetting to 8080/Z80,6809, 68000 (includes PASCAL compiler, Whitesmiths C native compiler, cross-assembler & all library outlines)	Price per target processor	£1095.00
PASCAL cross compiler targetting to 6502		£1650.00
PASCAL cross compiler targetting to 8086		£1650.00
XAB Cross assembler (price per processor)		£ 200.00

NETWORKING SOFTWARE  
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FUSION Ethernet Software for 68000/UNIX	(per processor)	£1250.00
FUSION Ethernet Software for VAX/UNIX	( " " )	£3000.00
FUSION Ethernet Software for IBM-PC(MS-DOS)	( " " )	£ 750.00



## SECTION SEVEN

## PERIPHERALS

Hazeltine Executive 10 Terminal	£ 685.00
ICL K9 Terminal	£ 515.00
DEC VT101 Terminal	£ 895.00
CIFER 2834/100 Terminal	£1095.00
CIFER 2842 Terminal	£1095.00
CIFER 3834 Terminal	£1095.00
CIFER 3842 Terminal	£1195.00
CIFER 3843 Graphics Terminal	£1195.00
CIFER 3843 Graphics Terminal	£1295.00
ANADEx 9501 Dot Matrix Printer	£1200.00
Epson MX100 FTIII Dot Matrix Printer	£ 560.00
Diablo 630 daisywheel with Tractor Feed	£1850.00
Mannesman Tally MT140L Near Letter Quality Printer	£ 880.00
NEC Colour Monitor (14 inch Screen)	£ 746.00
Sprint serial-parallel Interface (with 16K Buffer)	£ 245.00

## SECTION EIGHT

## CONSUMABLES

Floppy Disks (Verbatim, double sided, 96 T.P.I. Box of 10)	£ 44.00
Head Cleaner Kit (Floppy Drive)	£ 25.00
Cartridge Tape Cassette (2400ft, 10MB Capacity)	£ 33.00

## SECTION NINE

## MANUALS AND BOOKS

## PRICE

UNISIS	Operating Systems Manuals	£ 180.00
FORTTRAN	Fortran Manual	£ 35.00
PASCAL	Pascal Manual	£ 35.00
BASIC PLUS	Basic Plus Manual	£ 35.00
SMC BASIC	SMC Basic Manual	£ 35.00
68000 CPU	68000 CPU Hardware Manual	£ 30.00
Floppy Disk Cont.	Floppy Disk Controller hardware manual	£ 30.00
ST506 Controller	Winchester Disk Controller hardware manual	£ 30.00
SYSTEM	System Hardware Reference Manual	£ 30.00
C	"The C Programming Language" by Kernighan & Ritchie	£ 16.00
PASCAL	"A Practical Introduction to PASCAL" by Wilson & Addyman	£ 7.00
BASIC	"Introduction to Computer Programming with the BASIC Language"	£ 14.00

## SECTION TEN

## MAINTENANCE

NOTE: All systems are supplied with 90 day warranty. We strongly recommend that our Maintenance Contract is taken up, so as to provide you with efficient Hardware and/or Software Maintenance.

## UNIX SOFTWARE

## HARDWARE MAINTENANCE

## SYSTEM

## ANNUAL CHARGE

ANNUAL CHARGE  
off siteANNUAL CHARGE  
on site

SYS 0120-2	£250.00	£ 680.00	£ 900.00
SYS 0120-10	£250.00	£ 740.00	£ 950.00
SYS 0330-2	£250.00	£ 770.00	£1100.00
SYS 0330-10	£250.00	£ 835.00	£1150.00
SYS 0840-10	£250.00	£1140.00	£1500.00
SYS 0120-512-2	£250.00	£ 740.00	£1050.00
SYS 0330-512-10	£250.00	£ 950.00	£1250.00
SYS 0840-512-10	£250.00	£1250.00	£1650.00
SYS 0840-512-T-10	£250.00	£1470.00	£1930.00
SYS 0840-1024-10	£250.00	£1370.00	£1710.00
CTW300-64K-2W10-F	£250.00	£ 725.00	£1030.00
CTW300-64K-W33-F	£250.00	£ 795.00	£1130.00
CTW300-512K-2W10-F	£250.00	£ 825.00	£1180.00
CTW300-512K-W33-F	£250.00	£ 895.00	£1280.00
CTW300-512-W33-FT	£250.00	£1095.00	£1560.00
CTW300-512K-2W33-FT	£250.00	£1315.00	£1850.00
CTW300-512K-W80-F	£250.00	£1380.00	£1850.00
CTW300-512K-W80-FT	£250.00	£1580.00	£2400.00
CTW300-512K-W80-FM	£250.00	£2280.00	£3400.00
CTW300-512-2W80-FT	£250.00	£1985.00	£2980.00
CTW300-1024K-W80-F	£250.00	£1500.00	£2000.00
CTW300-1024K-W80-FT	£250.00	£1710.00	£2550.00
CTW300-1024K-W80-FM	£250.00	£2380.00	£3550.00

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#### D. COMPETITIVE EQUIPMENT CHARACTERISTICS





<u>MANUFACTURER:</u>	ADAGE	3000
PROCESSOR	Microprocessor Word length Bus architecture	
STORAGE	Minimum Maximum	
DISK	Fixed Removeable	
INPUT	Keyboard Mouse Other	YES
DISPLAY	Screen size Pixels Type	19" Raster Scan
PORTS		
PERIPHERALS		
OPERATING SYSTEM		KASM
LANGUAGES		IKASM (assembler) FORTAN, IDL, Graphics Display Languages
PRICE		\$19,000+

<u>MANUFACTURER:</u> APOLLO		DOMAIN DN 460/660
PROCESSOR	Microprocessor Word length Bus architecture	Custom 32 bit
STORAGE	Minimum Maximum	1Mb 4Mb
DISK	Fixed Removeable	68 - 158Mb 1.2Mb
INPUT	Keyboard Mouse Other	YES YES
DISPLAY	Screen size Pixels Type	19" 1024 x 800/1024 x 1024 monochrome/colour
PORTS		2 x RS-232C
PERIPHERALS		12M bits/s network and ETHERNET
OPERATING SYSTEM		DPSS and DSEE CORE, GKS UNIX
LANGUAGES		FORTRAN 77, C, PASCAL
PRICE		\$39,500/59,500

<u>MANUFACTURER:</u> AUTO-TROL		ADVANCED GRAPHICS WORKSTATION II
PROCESSOR	Microprocessor Word length Bus architecture	32 bit
STORAGE	Minimum Maximum	34Mb 1.2Mb
DISK	Fixed Removeable	
INPUT	Keyboard Mouse Other	YES Tablet
DISPLAY	Screen size Pixels Type	17 " 1,024 x 800 monochrome
PORTS		2 x RS232 + optional tablet port
PERIPHERALS		
OPERATING SYSTEM		AGEIS VMOS Series 5000 & Series 7000 Graphics software
LANGUAGES		
PRICE		\$60,000 - \$130,000

<u>MANUFACTURER:</u> CADMUS		CADMUS 9000
PROCESSOR	Microprocessor Word length Bus architecture	
STORAGE	Minimum Maximum	
DISK	Fixed Removeable	
INPUT	Keyboard Mouse Other	
DISPLAY	Screen size Pixels Type	
PORTS		
PERIPHERALS		10Mbit ETHERNET or 50M bit fibre optic LAN
OPERATING SYSTEM		UNIX Berkeley 4.2 enhancements UNISON networking software
LANGUAGES		C
PRICE		



<u>MANUFACTURER:</u> CALCOMP		CALCOMP 4000
PROCESSOR	Microprocessor Word length Bus architecture	2 x MC 68000 16 bit
STORAGE	Minimum Maximum	128Kb RAM (32K ROM) 1Mb
DISK	Fixed Removeable	
INPUT	Keyboard Mouse Other	Low cost Joystick/Data Tablet
DISPLAY	Screen size Pixels Type	19" 1024 x 1024 Raster monochrome
PORTS		RS-232C
PERIPHERALS		Screen Copier, Data Tablet, Trackball
OPERATING SYSTEM		
LANGUAGES		FORTTRAN Support Packages
PRICE		From \$14,000

<u>MANUFACTURER:</u> CHROMATICS		CHROMATICS CGC 7900
PROCESSOR	Microprocessor Word length Bus architecture	MC 68000 16 bit
STORAGE	Minimum Maximum	128Kb 8Mb
DISK	Fixed Removeable	Up to 40 Mb WINCHESTER Diskette
INPUT	Keyboard Mouse Other	YES Lightpen, joystick digitizer tablet
DISPLAY	Screen size Pixels Type	19" 1024 x 1024 Raster scan, monochrome, colour
PORTS		RS-232, RS-449
PERIPHERALS		Summagraphics Digitizer + Optional Printers
OPERATING SYSTEM		IDRIS/DOS
LANGUAGES		BASIC, PASCAL, ASSEMBLER
PRICE		\$12,995 - \$24,995

<u>MANUFACTURER:</u>	COMPUTER TECHNIK MÜLLER	CTM 9032
PROCESSOR	Microprocessor Word length Bus architecture	AMD 2901 Bit slice (8MHZ) 32Mb/s bus transfer rate
STORAGE	Minimum Maximum	1Mb -
DISK	Fixed Removeable	80Mb up to 4 x 300 Mb 16Mb
INPUT	Keyboard Mouse Other	YES
DISPLAY	Screen size Pixels Type	
PORTS		
PERIPHERALS		Line Printer
OPERATING SYSTEM		Proprietary
LANGUAGES		
PRICE		£10,000 - £15,000

<u>MANUFACTURER:</u>	CONVERGENT TECHNOLOGIES	MINIFRAME
PROCESSOR	Microprocessor Word length Bus architecture	Motorola 68010 16 bit
STORAGE	Minimum Maximum	512Kb 2Mb
DISK	Fixed Removeable	10,20 or 37MB Winchester 640Kb diskette
INPUT	Keyboard Mouse Other	
DISPLAY	Screen size Pixels Type	PT1 display
PORTS		300 Kbps RS422 option 10 multi-dropped RS232
PERIPHERALS		
OPERATING SYSTEM		UNIX
LANGUAGES		
PRICE		\$10,000 (\$4,000 for large OEM contracts)



<u>MANUFACTURER:</u> CORVUS		CORVUS CONCEPT
PROCESSOR	Microprocessor Word length Bus architecture	MC68000 16 bit
STORAGE	Minimum Maximum	
DISK	Fixed Removeable	
INPUT	Keyboard Mouse Other	
DISPLAY	Screen size Pixels Type	
PORTS		
PERIPHERALS		OMNINET LAN Removeable cartridge type
OPERATING SYSTEM		UNIX
LANGUAGES		
PRICE		£6,000 - £7,500

<u>MANUFACTURER:</u>	DUAL SYSTEMS	83/20
PROCESSOR	Microprocessor Word length Bus architecture	Motorola MC 68000 16 bit IEEE 696/S100 Bus Architecture
STORAGE	Minimum Maximum	
DISK	Fixed Removeable	
INPUT	Keyboard Mouse Other	
DISPLAY	Screen size Pixels Type	
PORTS		
PERIPHERALS		
OPERATING SYSTEM		UNIX III with Berkeley Enhancements
LANGUAGES		BASIC, COBOL, PASCAL, FORTRAN 77 and ASSEMBLER
PRICE		\$11,662 (OEM)

<u>MANUFACTURER:</u>		HEWLETT PACKARD	HP 9000 MODEL 520A
PROCESSOR	Microprocessor Word length Bus architecture		Proprietary 32 bit
STORAGE	Minimum Maximum		
DISK	Fixed Removeable		
INPUT	Keyboard Mouse Other		YES
DISPLAY	Screen size Pixels Type		13"/19"  Raster colour
PORTS			
PERIPHERALS			
OPERATING SYSTEM			HP-UX
LANGUAGES			FORTRAN, PASCAL, BASIC
PRICE	1Mb Memory, 10 Mb Winchester 13" colour display + BASIC		\$35,850
	1.5Mb Memory, 16Mb Winchester + HP-UX, FORTRAN or PASCAL		\$49,400

<u>MANUFACTURER:</u> IBM		(up to 16 or 32 display 5080 on a 5085 controller on a m/f)
PROCESSOR	Microprocessor Word length Bus architecture	16 bit bit-slice
STORAGE	Minimum Maximum	128Kb 1Mb
DISK	Fixed Removeable	Uses m/f
INPUT	Keyboard Mouse Other	Yes Mouse or stylus Up to 32 displays
DISPLAY	Screen size Pixels Type	1024 x 1024 non-interlaced Raster (50HZ)
PORTS		
PERIPHERALS		
OPERATING SYSTEM		
LANGUAGES		GAM/SP(2) support package
PRICE	Monochrome (16 grey shades) CPU and tablet  (16 colours)	\$19,750  \$24,750



<u>MANUFACTURER:</u> MEGATEK		3355
PROCESSOR	Microprocessor Word length Bus architecture	
STORAGE	Minimum Maximum	
DISK	Fixed Removeable	
INPUT	Keyboard Mouse Other	YES
DISPLAY	Screen size Pixels Type	19" 1024 x 1024 60HZ non-interlaced raster scan
PORTS		RS232C
PERIPHERALS		
OPERATING SYSTEM		
LANGUAGES		
PRICE		

<u>MANUFACTURER:</u> MASSCOMP		WORKSTATION 500
PROCESSOR	Microprocessor Word length Bus architecture	MC68000 & MC68010 16 bit 8Mb/s memory interconnect bus + MULTIBUS
STORAGE	Minimum Maximum	(4Kb cache) 6Mb
DISK	Fixed Removeable	
INPUT	Keyboard Mouse Other	
DISPLAY	Screen size Pixels Type	19" 1024 x 1024
PORTS		ETHERNET I/F
PERIPHERALS		
OPERATING SYSTEM		UNIX III Berkeley 4.2
LANGUAGES		
PRICE		

<u>MANUFACTURER:</u> NBI		SYSTEM ONE INTEGRATED WORKSTATIONf
PROCESSOR	Microprocessor Word length Bus architecture	MC68010 16 bit
STORAGE	Minimum Maximum	512Kb 1Mb
DISK	Fixed Removeable	12Mb/24Mb Winchester 5.24" diskette
INPUT	Keyboard Mouse Other	YES Mouse
DISPLAY	Screen size Pixels Type	1024 x 768
PORTS		
PERIPHERALS		
OPERATING SYSTEM		UNIX derivative Relational Data-base Management System
LANGUAGES		C
PRICE	Base Price	\$12,500

<u>MANUFACTURER:</u> NCR		TOWER 1632
PROCESSOR	Microprocessor Word length Bus architecture	MC68000 16 bit Multibus
STORAGE	Minimum Maximum	512Kb
DISK	Fixed Removeable	30Mb Winchester 1Mb diskette
INPUT	Keyboard Mouse Other	YES NO
DISPLAY	Screen size Pixels Type	Colour (up to 16)
PORTS		8I/O
PERIPHERALS		
OPERATING SYSTEM		UNIX
LANGUAGES		
PRICE		£12,000 (quantity discounts available)



<u>MANUFACTURER:</u> PERKIN-ELMER		7350 PROFESSIONAL COMPUTER	
PROCESSOR	Microprocessor Word length Bus architecture	MC68000 16 bit	
STORAGE	Minimum Maximum	320Kb 1Mb	
DISK	Fixed Removeable	15Mb Winchester 2 x double sided, double density diskette	
INPUT	Keyboard Mouse Other	YES NO -	
DISPLAY	Screen size Pixels Type	15" 720 x 256 Monochrome/colour	
PORTS		2 x RS23C	
PERIPHERALS			
OPERATING SYSTEM		UNIX System III	
LANGUAGES		FORTRAN, C	
PRICE	Single User Colour	£7,430 (\$8,400) £9,200 (\$10,400)	

<u>MANUFACTURER:</u> ICL		PERQ 2
PROCESSOR	Microprocessor Word length Bus architecture	CMOS gate array CPU 32 bit
STORAGE	Minimum Maximum	512Kb (4KWCS) 2Mb
DISK	Fixed Removeable	40Mb 1Mb diskette
INPUT	Keyboard Mouse Other	YES YES Graphics Tablet
DISPLAY	Screen size Pixels Type	13" or 20" 1280 x 1024 (60HZ) Monochrome raster
PORTS		RS232 ETHERNET
PERIPHERALS		200 chps matrix printer 40 chps daisywheel Streaming tape, PLP-10 laser printer, 1,000 lpm printer plotter
OPERATING SYSTEM		UNIX, RAPPORT relational database management system
LANGUAGES		C, FORTRAN, PASCAL
PRICE		£15,000 (\$14,000 - \$41,000)

<u>MANUFACTURER:</u>	PIXEL	PIXEL 80G (can support up to 16 terminals)
PROCESSOR	Microprocessor Word length Bus architecture	MC68010 16 bit
STORAGE	Minimum Maximum	1/2Mb 6Mb
DISK	Fixed Removeable	40Mb diskette/5Mb Winchester
INPUT	Keyboard Mouse Other	YES
DISPLAY	Screen size Pixels Type	1,728 x 2,180
PORTS		
PERIPHERALS		20Mb cartridge tape
OPERATING SYSTEM		UNIX III Berkeley extensions
LANGUAGES		C, PASCAL, ADA, APL, FORTRAN COBOL, BASIC
PRICE		\$20,000

<u>MANUFACTURER:</u>	HIGH LEVEL HARDWARE	ORION
PROCESSOR	Microprocessor Word length Bus architecture	AMD29014 bit-slice 32 bit
STORAGE	Minimum Maximum	1Mb 10Mb
DISK	Fixed Removeable	80Mb cartridge tape
INPUT	Keyboard Mouse Other	YES
DISPLAY	Screen size Pixels Type	1K x 1K screen planned
PORTS		4 terminal ports
PERIPHERALS		
OPERATING SYSTEM		UNIX 4.1
LANGUAGES		C, PASCAL, FORTRAN 77, BCPL
PRICE		£14,000



<u>MANUFACTURER:</u> SIGMA ELECTRONICS		6100
PROCESSOR	Microprocessor Word length Bus architecture	MC68000 16 bit
STORAGE	Minimum Maximum	
DISK	Fixed Removeable	
INPUT	Keyboard Mouse Other	1,448 x 1,024 Monochrome and colour
DISPLAY	Screen size Pixels Type	
PORTS		
PERIPHERALS		
OPERATING SYSTEM		
LANGUAGES		
PRICE		\$10,000 to \$17,000

N.B. Ferranti was involved in the product development and will be a major OEM customer.

<u>MANUFACTURER:</u> SUN		
PROCESSOR	Microprocessor Word length Bus architecture	MC68010 (10MHz) 16 bit
STORAGE	Minimum Maximum	
DISK	Fixed Removeable	
INPUT	Keyboard Mouse Other	
DISPLAY	Screen size Pixels Type	
PORTS		
PERIPHERALS		
OPERATING SYSTEM		UNIX
LANGUAGES		
PRICE		\$15,400

<u>MANUFACTURER:</u>	SYMBOLICS	3600
PROCESSOR	Microprocessor Word length Bus architecture	Tagged-stock architecture 32 bit
STORAGE	Minimum Maximum	2.3Mb 34Mb
DISK	Fixed Removeable	169Mb - 1.8Gb
INPUT	Keyboard Mouse Other	YES
DISPLAY	Screen size Pixels Type	17" 1,100x800 or 1,280x1,024 colour monochrome raster
PORTS		1 parallel, 3 serial Ethernet interface
PERIPHERALS		Laser Printer
OPERATING SYSTEM		Zeta Lisp
LANGUAGES		LISP, FORTRAN 77, C, PASCAL INTERLISP
PRICE		

<u>MANUFACTURER:</u> TEXAS INSTRUMENTS		NUMACHINE
PROCESSOR	Microprocessor Word length Bus architecture	MC68010 37.5Mbps NUBUS
STORAGE	Minimum Maximum	512Kb (4Kb cache)
DISK	Fixed Removeable	84MB
INPUT	Keyboard Mouse Other	YES
DISPLAY	Screen size Pixels Type	800 x 1,024 monochrome
PORTS		
PERIPHERALS		¼" streaming tape
OPERATING SYSTEM		UNIX
LANGUAGES		FORTRAN
PRICE		\$36,240 (in quantity)



<u>MANUFACTURER:</u> WEST		WEST 3000
PROCESSOR	Microprocessor Word length Bus architecture	INTEL 8086/8087/8088
STORAGE	Minimum Maximum	1Mb
DISK	Fixed Removeable	20Mb - 4 x 40Mb 640 Kb
INPUT	Keyboard Mouse Other	
DISPLAY	Screen size Pixels Type	Colour
PORTS		
PERIPHERALS		
OPERATING SYSTEM		INTEL RMX-86
LANGUAGES		SUPERBASIC + Standard Languages
PRICE		\$12,000



## APPENDIX C.





## APPENDIX C : COMPLETED QUESTIONNAIRES : MARKET POTENTIAL



INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

# TYPE OF S/W DEVELOPMENT

## 1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM? *This area is addressed by MERUN primarily towards office automation applications - interviewee not prepared to discuss.*

Market Segment	% of Business	H/W	O/S	Language	Application

b) Embedded systems? *Examples would be microprocessor in telephone to handle short code dialling, distribution of intelligence within network as a function of the cost balance.*

Application Type/Product	% of Business	H/W	O/S	Language
<i>Not prepared to provide specific statistics.</i>				*

## c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor ✓			Telephone	
Mini ✓		*	type	
Mainframe ✓			applications.	
Other - please specify SYSTEM X		CORAL	eg Switching.	

\* Use of language is dependent on how much retrofitting has to be done: BT use Assembly / PASCAL / C / CORAL and probably ADA in future. Also important is the CCITT language CHILL which is similar to ADA but uses different terminology. Would not use Modula.



2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?

\_\_\_\_\_

- b) Do you attach your own or other manufacturers equipment to your systems?

\_\_\_\_\_

- c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:

Markets: \_\_\_\_\_

Products: \_\_\_\_\_

- d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX)  
Window Systems/Operating Environments  
Languages (eg FORTRAN 77, PASCAL)  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price  
Anything else

- e) What do you find most restricting about the equipment you are currently marketing as an OEM?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3.

- a) How many software development programmers do you employ?

In excess of 200 in National Networks, 200+ on System X.

There are all Professional programmers on large S/W developments.

Minimum project size 5-10 man years.

- b) How many development m/c's do you have?

Number not available ; Types are IBM / ICL / DEC VAX etc.

- c) What is the approximate total spent on software development per annum?

---

- d) Do you subcontract software development work to third parties?

---

- e) If so, what proportion of the above is subcontracted?

# SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification	X			
Design	X			
Programming		X		
Construction		X		
Documentation	X			
Verification	X			
Operation	X			

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

*15-25% in a 1M line type project*  
*Could be ~~only~~ 30-40% for a Real-Time project.*

5. Which of the following statements best fits your position with regard to programmer productivity?

a) We measure programmer productivity

☒

b) We have attempted to do this

☐

c) We would like to

☐

d) We do not measure it

☐

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

*All of these  
 measured to  
 some extent*

Comment	Specific unit of measurement
Cost Related	<i>Different development units are used for different types of work eg Real-Time and number crunching: have different average lines of code</i> <i>also taken into account are time-scale</i> <i>and the level of staff used.</i>
Time Related	
Quality Related	

PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

*Choice of language not important from a productivity point of view. For existing systems not an option because of cost - for new development it would only be one of several factors.*

7. Do you or do you intend to use specific languages for program development?

No                      Why Not? \_\_\_\_\_

Yes ✓

What languages(s) do you use? CORAL, PASCAL, C.

What productivity improvement have you achieved *(Portability important.)*

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No                      Why is that? \_\_\_\_\_

Yes ✓

b) What type of machine(s)? \_\_\_\_\_

c) What productivity improvement have you achieved?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

d) Are these machines connected in anyway? (eg LAN)

Interconnection is vital.



9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
( )  
( )

*If centralised development, would depend on the response time whether to go distributed - also on size of development. 2-3 man year project not important (not so easy on 1 unit) 1½M - 2M lines of code - shared data bus vital.*

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX

*UNIX because of the bandwagon effect - not liked by ALVEY are supporting*

Local Area Network Connection (LAN)

*✓*

Specific LAN Protocol (eg ETHERNET)

*BT use ETHERNET rather than, not important if you use PSS.*

Other

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.  
Use a scale of 10 very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA 2		
COBOL	9	
BASIC	Easiest 10	
FORTRAN		
PASCAL	9	
ADA	Hardest 1	<i>Difficult to judge - too early not enough experience</i>
C	8	
CORAL ALGOL Other Languages CHILL	1	

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

12.  
8.

- a) How much have you spent in the last year on specifically increasing programmer productivity?

Have definite budget for productivity - not prepared to reveal.

Using developments like automatic code generator programmes, automatic documentation tools.

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

we SDL

System Description Language

Productivity emphasis is on specification stage and accuracy of design - coding is trivial part of operation. As h/w cost has fallen efficiency has become (not unimportant) but less important.

RESPONDENT

: Ray Cheung

TITLE

: Head of S/W Engineering Standard

COMPANY

: BRITISH TELECOM

ADDRESS

: 207 Old Street

London EC1V 9TS

TOTAL REVENUE OF COMPANY

: —

TOTAL NUMBER OF COMPANY EMPLOYEES

: 250,000 (9,000 in Headquarters)

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

# TYPE OF S/W DEVELOPMENT

## 1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application
	10% of Business is selling to OEM's very little in terms of systems				

b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language
GLASS TELETYPE & OTHER SPECIFIC FUNCTIONS REAL-TIME MILITARY APPLICATIONS	5-10%	Z1106 Z80 INTEL 80816	-	ASSEMBLER PASCAL

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor Mini {FERRANTI ARGUS 700}	OSC 245 (PROPRIETARY) O/S	CORAL 66 FORTRAN	MILITARY PROCESS CONTROL TELEMETRY INFORMATION COLLECTION	≈ 45%
Mainframe			PRINT COMPOSING AND MESSAGE SWITCHING	
Other - please specify			TYPESETTING	≈ 45%



2. FOR OEM BUSINESS ONLY: <sup>- 2 -</sup> FERRANTI are interested in expanding their OEM activity from a very limited base if it meets business requirements.

a) Do you make engineering changes to the products you buy in? requirements.

YES (Printers, Disks etc to be added to their own equipment)

b) Do you attach your own or other manufacturers equipment to your systems?

YES He Purchases.

c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:

Markets: Expand into US Market + Real-Time Transaction market/ office automation.

Products: No serious plans have yet. are looking at DISER in respect of in plant printing.

d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX)  
Window Systems/Operating Environments  
Languages (eg FORTRAN 77, PASCAL)  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price  
Anything else

Products / Markets must contribute towards business plan and have coherency with existing product line. Mainly being considered as a method of plugging a hole in the product line.

e) What do you find most restricting about the equipment you are currently marketing as an OEM?

---

---

---

3.

a) How many software development programmers do you employ?

Around 500 - 150 writing functional S/W, languages, operating systems.  
- about 100 in a support role and 250 writing applications for turnkeys.

b) How many development m/c's do you have?

30 dedicated development machines - some are multi-user  
some single user - additionally about 150-250 development terminals.

c) What is the approximate total spent on software development per annum?

≈ £2M.

d) Do you subcontract software development work to third parties?

Yes, sometimes; usually in a joint bidding situation.

e) If so, what proportion of the above is subcontracted?

5% of basic S/W development - could be  
as much as 10-30% in a particular joint bid.

SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification	<i>Very High emphasis</i>			
Design		✓		
Programming			✓	
Construction		✓		
Documentation		✓		
Verification	✓			
Operation				✓

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

*10%*

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☐
- c) We would like to ☐
- d) We do not measure it - *Do not have the time - Bottleneck is in the testing phase* ☒

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related		
Quality Related		



PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
(✓)  
( )  
( )  
( )  
( )

But would not make recommendation on basis of programmer productivity - could only be part justified on this basis. Achieving design correctness is principal factor - Have chosen Modula-2 over ADA but it was a close run thing.

7. Do you or do you intend to use specific languages for program development?

No

Why Not? \_\_\_\_\_

Yes ✓

What languages(s) do you use? Modula-2 / Pascal / C

What productivity improvement have you achieved

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
( )  
( )

not tested

For processor X development 50% over assembler. not an improvement

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

Not really  
Yes

Why is that? \_\_\_\_\_

Economic reasons.

- b) What type of machine(s)? ARGUS used a little in this way.

- c) What productivity improvement have you achieved?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
( )  
( )

Giving a programmer his own machine is not necessarily a recipe for good productivity. - temptation to just play with the S/W.

- d) Are these machines connected in anyway? (eg LAN)

\_\_\_\_\_



9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5%	( )
5-14%	( ? )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

*It would have to show an economic case - might be 10%.*

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX

UNIX environment

Local Area Network Connection (LAN)

YES

Specific LAN Protocol (eg ETHERNET)

Probably ETHERNET

Other

*Centralised resource control for files*

*X-Compilers to target systems*

*In Circuit Emulation (ICE), Source debugging on development machine*

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.

Use a scale of 10 very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of <sup>†</sup> Producing Quality S/W
MODULA-2		8
COBOL	{ From standpoint of CORAL	-
BASIC		3
FORTRAN	MODULA-2 PASCAL	5
PASCAL	ADA are easier	7
ADA	to learn.	8
C		2
CORAL		6
ALGOL		
Other Languages		
Assembler		1

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

<sup>†</sup> This is a dominant factor for FERRANTI in choice of languages.

12.  
8.

- a) How much have you spent in the last year on specifically increasing programmer productivity?

In excess of £1/4 M on project productivity.<sup>†</sup>

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

(X)  
( )  
( )  
( )  
( )  
( )

*Would be surprised if prepared  
to spend more than 5%.*

<sup>†</sup> This included purchase of a VAX to provide a uniform development environment - also for processors and for tools, word-processing and project planning.

RESPONDENT

: Mr D. Thwaite

TITLE

: PRODUCT MANAGER

COMPANY

: FERRANTI COMPUTER SYSTEMS LTD

ADDRESS

: SIMONSWAY

WYTHENSHANE

MANCHESTER M22 5LA

TOTAL REVENUE OF COMPANY (COMPUTER SYSTEMS)

£125M

TOTAL NUMBER OF COMPANY EMPLOYEES :

1

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

## TYPE OF S/W DEVELOPMENT

### 1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM? Yes GEC are active in this area - eg they have an agreement with Convergent Technologies - not prepared to give details.

Market Segment	% of Business	H/W	O/S	Language	Application
—	—	Convergent Technologies N-Gen.	—	—	—

There exists no overall company policy with regard to H/W-S/W used, each constituent company does its own thing. Chips are bought in, some are made internally.

b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language
—	—	—	—	—

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor 68000 etc† Mini VAX Mainframe GEC 6300 series PDP-11 Other - please specify	UNIX	C Modular-2† FORTRAN PASCAL CORAL	<u>Distributed Computing</u> • Networks • Communications • Man-machine interface. (Telecomms)	10% of Group.*

† make use of most standard processors available + design their own.

† Use Modular-2 compilers developed at Rutherford & Cambridge.

\* This represents prime area of this particular Research Group



N.B. Interviewee was only able to answer some questions on OEM activity as not directly responsible.  
- 2 -

2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?

YES

- b) Do you attach your own or other manufacturers equipment to your systems?

YES

- c) Are you looking for new OEM opportunities either in terms of markets or products? YES, but could not be specific.

Please give indication of what these are:

Markets:

Products:

- d) Do you have any specific criteria for new OEM products?

Some various equipment to be received as input out for GEC in laboratories.  
Operating System (eg UNIX) S/W Tools available are more important.  
Window Systems/Operating Environments plus ability to communicate.  
† Languages (eg FORTRAN 77, PASCAL) Modula-2, [Fortran, PASCAL, Lisp, etc.]  
LAN protocols (eg ETHERNET) Needs to be wide band (3Mbit, 10K?)  
Response time  
Graphics (eg Resolution, Colour) Bit mapping in memory  
Mouse Important. Colour is critical for CAD/CAE.  
Printing (essential for VLSI)  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price Price - very important. He lessons  
Anything else Cost of a workstation should of Zencr star.  
approximate to 6 months salary of operator -  
ie £10K for £20K professional

- e) What do you find most restricting about the equipment you are currently marketing as an OEM?

† A single-language won't sell - need to capitalise on massive software development already available

‡ 1000 x 1000 resolution adequate for majority of purposes  
refresh rate needs to be 70 HZ - 50 HZ not good enough at 60 HZ  
still has flicker at edge of screen.

Mitsubishi offer a 1000 x 1000 screen for around £3.5K.  
'resolution v colour is a cost pay off' - but cost differential coming down.  
Readout quality not good enough to use all day.

3.

a) How many software development programmers do you employ?

GEC employ in excess of 3,000 - interviewees department

employ 15, 10 writing in C, 5 writing in Modula 2.

C is particularly important as demanded for Telecomms.

b) How many development m/c's do you have?

In this department; 5 X 68000 + various comms processors

3 or 4 Z80 based ETHERNET servers; LSI-11, GEC 6300, VAX 11/780.

c) What is the approximate total spent on software development per annum?

Unable to quantify.

d) Do you subcontract software development work to third parties?

e) If so, what proportion of the above is subcontracted?

are conscious that they take a lot of short cuts in s/w development - using no light spec or particular quality control methodology.

SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification				X
Design	X			
Programming		X		
Construction	X			
Documentation	X			
Verification	X			
Operation				X

(Implementation and Integration are key factors)

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

50% . { 3 man year project is a big project for this particular department }

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☐
- c) We would like to ☐
- d) We do not measure it << Far too much else to do >> ☒

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related		
<u>Quality Related</u>		Quality of the s/w is clearly important, << Does it work? >>



PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

(✓)  
( )  
( )  
( )  
( )  
( )

if language gives other advantages  
eg Modular 2 gives increase in  
reliability over C + massive  
increase in maintainability.

7. Do you or do you intend to use specific languages for program development?

No

Why Not? \_\_\_\_\_

Yes ✓

What languages(s) do you use? C, Modular-2 may consider

What productivity improvement have you achieved

EDISON, EUCLID  
PROLOG For AI

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
(X)  
( )  
( )  
( )

Not possible to stay with precision  
possibly around 25%.

Believes Modular-2 will take off  
like PASCAL.

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No X

Why is that? \_\_\_\_\_

This is definitely the next stage  
but is too expensive at the moment.

Yes

- b) What type of machine(s)? \_\_\_\_\_

- c) What productivity improvement have you achieved?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
( )  
( )

- d) Are these machines connected in anyway? (eg LAN)

\_\_\_\_\_



9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( ) S/W Tools are most important - both  
( ) off the shelf + prepared to write some  
( ) themselves - currently many are  
(50)% available but not integrated - they  
( ) do not work together.

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX

Only use UNIX at the moment but are looking for something better - UNIX good for program development but not for Real-Time

Local Area Network Connection (LAN)

Essential

Specific LAN Protocol (eg ETHERNET)

Probably ETHERNET but there are a number of military systems which are important.

Other

Portability of programs  
Sharing Files printers  
& other relatively expensive resources.

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.

Use a scale of 10 very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA-2	Not easier to learn.	Very easy 10
COBOL		
BASIC		
FORTRAN		
PASCAL		
ADA	Too big to learn all functions. †	Too big
C	Easy to learn but † like assembler	5
CORAL		
ALGOL		
Other Languages		

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

† Readability is the problem.

‡ With modular it is possible to keep all functions within ones head - with ADA one can only keep a subset ∴ you get different dialects appearing

12.  
8.

- a) How much have you spent in the last year on specifically increasing programmer productivity?

*Probably 5-10% of programming effort - developing S/W too for C, Modular-2 computers, Full Screen editors, syntax checker etc.*

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( ) %  
(10) %  
( )  
( )  
( )  
( )

*Would probably like to spend more but cannot raise from development companies the necessary funds.*

RESPONDENT

: David Ottway

TITLE

: Divisional Manager, Information

COMPANY

: Hirst Research Labs - GEC

ADDRESS

: East Lane

Wembley

Middlesex

TOTAL REVENUE OF COMPANY

:

TOTAL NUMBER OF COMPANY EMPLOYEES

:

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

3.2.84

#4

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

# TYPE OF S/W DEVELOPMENT

## 1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application
Military	40%	DEC VAX PDP-11	UNIX	CORAL 66 (95% is in this language)	Various military.

b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language
Military 5% in Commercial Industrial.	30%	Various processors Z8000	UNIX	PASCAL C

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor Mini VAX Mainframe Other - please specify	VMS	CORAL 66	Power Generation Process Control Energy	30%



2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?  
only very limited changes. (Will build their own hardware from scratch in some cases).
- b) Do you attach your own or other manufacturers equipment to your systems?  
Printers / peripherals - electrical screening.

- c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:

Markets: Attempting to expand away from military - difficult as different type of setting.

Products: —

- d) Do you have any specific criteria for new OEM products?

Operating System (eg UNIX) VMS / UNIX {Target m/c is base micro}  
Window Systems/Operating Environments Quite important.  
Languages (eg FORTRAN 77, PASCAL) → important for scientific market  
LAN protocols (eg ETHERNET) ✓ but CORAL 66, C, PASCAL, ADA.  
Response time Better to have some access than  
Graphics (eg Resolution, Colour) no access. → bandwidth not the only problem, allocation of access important.  
Mouse ✓  
Printing Very important  
Memory Size  
Disk Storage } Greater capabilities to overcome fact that DEC cannot get its act together on VAX  
Software Development (eg Speed of)  
Price Very important  
Anything else

- e) What do you find most restricting about the equipment you are currently marketing as an OEM?

Restriction of 20 users on a VAX  
and no transfer from VMS.

Screen comfort and report preparation useful.

3.

- a) How many software development programmers do you employ?

420 professional programmers (85% working at a high-l. " )  
out of a total headcount of 520

- b) How many development m/c's do you have?

4 x VAX      4 x PDP 11

- c) What is the approximate total spent on software development per annum?

**d) Do you subcontract software development work to third parties?**

Very rarely.

- e) If so, what proportion of the above is subcontracted?

Small.

SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Programming	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Construction	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

30 - 40 %

Some projects are as large as 25-30 man years  
Typical size is 4-5 man years  
Some are 1 man year.

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☒
- c) We would like to ☐
- d) We do not measure it ☐

half-hearted  
{ in an environment where  
much code is written and  
thrown away. }

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related		
Quality Related	Vitaly important - do have a project control structure document which measures	

man years and code produced etc.  
Project control is based on principal of how much work is still to be done - not on what has to be done







9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5% ( )  
 5-14% ( )  
 15-25% ( )  
 25-49% ( )  
 50-99% ( )  
 100% or more ( )

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX \_\_\_\_\_

Local Area Network Connection (LAN) \_\_\_\_\_

Specific LAN Protocol (eg ETHERNET) \_\_\_\_\_

Other *Modularity important - language unimportant*  
*Strong Typing is a good feature*

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.  
 Use a scale of 10 very easy to 1 very hard

	Relative Ease <sup>†</sup> of Learning	Relative Ease of Producing Quality S/W
MODULA - 2	8	7
COBOL		
BASIC	10	1
FORTRAN		
PASCAL	8	7
ADA	1	8
C	2	3
CORAL 66 ALGOL Other Languages	7	5

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

<sup>†</sup> Does not consider however that there is much difference for a professional programmer. eg ADA not a problem.

12.  
8.

- a) How much have you spent in the last year on specifically increasing programmer productivity?

Nothing.

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

*Cost saving rather than productivity is the main factor.*

RESPONDENT

: Ken Jackson

TITLE

: PRINCIPAL CONSULTANT

COMPANY

: SYSTEMS DESIGNERS LTD

ADDRESS

: 1 Pembroke Broadway  
CAMBERLEY

Surrey GU15 3XH

TOTAL REVENUE OF COMPANY

: £ 10-12M

TOTAL NUMBER OF COMPANY EMPLOYEES

: 520

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

3.2.84

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

# TYPE OF S/W DEVELOPMENT

## 1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

### a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application
Energy management in OS market. Manufacturing (UK) Germany	30%	DEC VAX IBM  H/P  DEC/ALEXUS		ASK Package (MAN MAN)	MRP  Programming Productivity.

### b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language
	30%	wide range including IBM and DEC	VMS etc	FORTTRAN CORAL 66 ADA

### c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor Mini Mainframe Other - please specify				Tends to be tied in with embedded or OEM software.



2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?

Not in general, add some controls on DEC equipment.

- b) Do you attach your own or other manufacturers equipment to your systems?

Missile fire-control system built in UK and some remote terminals built by SCICON.

- c) Are you looking for new OEM opportunities either in terms of markets or products? YES

Please give indication of what these are:

Markets: Particularly standard products for vertical markets

Products: eg MANMAN and CAD in manufacturing.

- d) Do you have any specific criteria for new OEM products?

Operating System (eg UNIX)  
Window Systems/Operating Environments  
Languages (eg FORTRAN 77, PASCAL)  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price  
Anything else

*Could not be specific.*

- e) What do you find most restricting about the equipment you are currently marketing as an OEM?

No particular restrictions known - feels that there are too many things on offer in the market at this point in time.

3.

a) How many software development programmers do you employ?

around 800 out of a total staff of 3,000.

b) How many development m/c's do you have?

DEC VAX is dominant / develop on customers machines  
one PRIME mini is used in FRANCE

c) What is the approximate total spent on software development per annum?

—

d) Do you subcontract software development work to third parties?

YES

e) If so, what proportion of the above is subcontracted?

But only a fairly small percentage.

SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Programming	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Construction	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

For a typical project (3-5 man yrs, not all programmers.) 30-40%

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☐
- c) We would like to *(Not formally)* ☒
- d) We do not measure it ☐

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related		
Quality Related		

PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
(X)  
( )  
( )  
( )  
( )

*If provable is it must be measurable -  
companies are out to make money.*

*Programmers would not think twice about using a new language but*

*problem for management is the RISK v Probability of achieving a benefit*

7. Do you or do you intend to use specific languages for program development?

No



Why Not?

*Program language use just grows eg  
CORAL, FORTRAN, PASCAL.*

Yes

What language(s) do you use? \_\_\_\_\_

What productivity improvement have you achieved

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
( )  
( )

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No

Why is that? \_\_\_\_\_

Yes



- b) What type of machine(s)? VAX

- c) What productivity improvement have you achieved?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
( )  
( )

*Not measured,  
capability of machine  
is assessed.*

- d) Are these machines connected in anyway? (eg LAN)

\_\_\_\_\_



9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5%	( )	<i>Don't know</i>
5-14%	( )	
15-25%	( )	
25-49%	( )	
50-99%	( )	
100% or more	( )	

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX UNIX and C

Local Area Network Connection (LAN) ✓

Specific LAN Protocol (eg ETHERNET) \_\_\_\_\_

Other *Good Graphics Package, integrated into OS  
a Data Base, then consider the language.  
High resolution colour.*

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.  
Use a scale of 10 very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA-2		
COBOL		
BASIC		
FORTRAN		<i>Unable to be specific, thought it very difficult to write good software in BASIC.</i>
PASCAL		
ADA		
C		
CORAL ALGOL Other Languages		

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

*Structure of the language is important.*

12.  
8.

- a) How much have you spent in the last year on specifically increasing programmer productivity?

Around 2-3% of development budget on buying and developing software tools.

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

RESPONDENT

: P. E. Merritt

TITLE

: Research and Development Co-ordinator

COMPANY

: SCICON Intl. Ltd

ADDRESS

: 49 Berners Street

London

W1P 4AQ

TOTAL REVENUE OF COMPANY

: \$ 175 M

TOTAL NUMBER OF COMPANY EMPLOYEES

: 3,500

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

3.2.84

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

TYPE OF S/W DEVELOPMENT

1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application
	(new development)	TELEVIDEO			

b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language
Software Sciences processor development. Defence Electronics.		68000		

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor				
Mini				
Mainframe				
Other - please specify				



2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?

No

- b) Do you attach your own or other manufacturers equipment to your systems?

NO

- c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:

Markets: YES in Peripherals

Products: YES if markets are big enough.  
manufacture under license.

- d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX)  
Window Systems/Operating Environments  
Languages (eg FORTRAN 77, PASCAL)  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price  
Anything else

{ Prefer to have }  
{ manufacturing }  
{ rights }

- e) What do you find most restricting about the equipment you are currently marketing as an OEM?

---

---

---

3.

a) How many software development programmers do you employ?

---

b) How many development m/c's do you have?

---

c) What is the approximate total spent on software development per annum?

---

d) Do you subcontract software development work to third parties?

*Would be opportunistic*

---

e) If so, what proportion of the above is subcontracted?

---

SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input checked="" type="checkbox"/> 50%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Programming	<input type="checkbox"/> 25%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Construction	<input type="checkbox"/> Testing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/> 25%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verification	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

25%

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☐
- c) We would like to ☒ - do not think there is a definitive way
- d) We do not measure it ☐

If a) or b) or c)

- e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related		
Quality Related		

PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%	( )	<i>Not a productivity issue, it depends on the environment. Sometimes one is told what to develop the software or depends on application performance may have to use microcode</i>
5-14%	( )	
15-25%	( )	
25-49%	( )	
50-99%	( )	
100% or more	( )	

7. Do you or do you intend to use specific languages for program development?

No                      Why Not? Not sure at the moment.

Yes  
What languages(s) do you use? \_\_\_\_\_

What productivity improvement have you achieved

Less than 5%	( )	<i>Must have X-compilers and be able to optimize code for cheap micros.</i>
5-14%	( )	
15-25%	( )	
25-49%	( )	
50-99%	( )	
100% or more	( )	

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No                      Why is that? \_\_\_\_\_

Yes *Separate machines have not delivered any apparent productivity gains.*

- b) What type of machine(s)? not for teams

- c) What productivity improvement have you achieved?

Less than 5%	( )	<i>They need disciplines linking together centralized dictionary must design automation system</i>
5-14%	( )	
15-25%	( )	
25-49%	( )	
50-99%	( )	
100% or more	( )	

- d) Are these machines connected in anyway? (eg LAN)
- \_\_\_\_\_



9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5% ( )  
 5-14% ( )  
 15-25% ( )  
 25-49% ( )  
 50-99% ( )  
 100% or more ( )

*How do you measure it?  
 Need to write improvement off  
 over 2-3 years.*

10. Would you have any specific requirements in connection with the introduction of a new development environment?

*UNIX has poor protection  
 for modules*  
 Operating System eg UNIX

*Single machine argument not yet  
 satisfactory.*

Local Area Network Connection (LAN) *Not improved with LAN technology.*

Specific LAN Protocol (eg ETHERNET)

Other *Shared files - the ability to be able to develop one's  
 own tools - word processing - good facilities  
 3270 / SNA protocols*

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.

Use a scale of 10 very easy to 1 very hard

*Depends on particular application  
 and environment.*

	Relative Ease of Learning	Relative Ease of Producing Quality S/W	
MODULA-2			
COBOL		Hard to test	
BASIC			
FORTRAN	( trivial )		
PASCAL		Very bad in commercial environment.	
ADA			ADA very heavily hyped.
C			very hard
CORAL ALGOL Other Languages			

*Need mixed  
 language  
 programming  
 with common  
 data structures*

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

*Clear pattern exists - well entrenched languages  
 are hard to beat - stability of environment -  
 efficiency of compilers makes up for it.*

12.  
8.

- a) How much have you spent in the last year on specifically increasing programmer productivity?

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

RESPONDENT

: V A J Maller

TITLE

: Director of Technology

COMPANY

: THORN - EMI INFORMATION TECHNOLOGY

ADDRESS

: Sunbury House  
79 Staines Road West  
Sunbury on Thames.

TOTAL REVENUE OF COMPANY

(<sup>TOTAL</sup><sub>COMPANY</sub>) £ 2.8 B ) IT £ 200M

TOTAL NUMBER OF COMPANY EMPLOYEES :

( 75,000 ) = 2,000

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

TYPE OF S/W DEVELOPMENT1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

## a) OEM?

Market Segment	% of Business OF OPERATIONS	H/W	O/S	Language	Application
① TELEPHONE SWITCHING	30%	DP	80% of DP purchases	PASCAL CHILE	TELECOMS.
TRANSMISSION	15%	=	20% of DP purchases	FORTRAN	ALL GROUP
OFFICE EQUIP	10%	90%		PASCAL CHILE.	ACTIVITIES of
" " PRIVATE TELEPHONE SYS	10%			ADA	Market
ELECTRONIC MAIL	10%			APL	Segments.
ENGINEERING	10%			CPM 86.	

e. military → PROFESSIONAL ELECTRONICS PROCESSES 10%.

C BASIC.

## b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language
TELECOMS - dedicated functions	20%	-	-	PASCAL CHILE CPM 86
microprocessors	5%			

## c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor	own Unix derived OS.	CPM 86		10%
Mini	CEDEX	PASCAL		
Mainframe	UMS	CHILE		
Other - please specify	IBM			



2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?  
YES re programs.  
YES re HW (it's obligatory)  
NB. Adapt equipment but do not modify it.
- b) Do you attach your own or other manufacturers equipment to your systems?  
YES - mainly own systems: processors disk's  
printers  
vdus.
- c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:

Markets: \_\_\_\_\_

Products: \_\_\_\_\_

- Looking for manufacturers - not new products. Tend to wait until products are proven before using them eg waiting until Ada is fixed & stable & then will use.
- d) Do you have any specific criteria for new OEM products?  
NATIONWIDE FIELD MAINTENANCE  
Operating System (eg UNIX) NOT SO IMPORTANT.  
Window Systems/Operating Environments VERY IMPORTANT.  
Languages (eg FORTRAN 77, PASCAL) UNIMPORTANT  
LAN protocols (eg ETHERNET) RELATIVELY IMPORTANT.  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size ONLY AFFECTS SPEED OF PROCESSING + IS INEXPENSIVE  
Disk Storage ALWAYS A PROBLEM re ACCESS TO LARGE VOLUME OF INFO  
Software Development (eg Speed of) SPEED NOT CRITICAL: ARCHIVE ADMIN MORE IMPORTANT  
Price NOT SO IMPORTANT FOR COMPETITIVE PRODUCTS.  
Anything else PRODUCT LIFE - DURABILITY.  
CAD. VERY IMPORTANT.
- e) What do you find most restricting about the equipment you are currently marketing as an OEM?  
PROBLEMS OF EXPORTATION & AMERICAN PROTECTIONIST STRATEGIES  
SOFTWARE TOOLS - PROBLEM THAT SOLD AS PART OF SYSTEM - SHOULD BE SOLD SEPARATELY.  
PROBLEM OF SW ROYALTIES - FEELS THAT SHOULD ONLY HAVE TO PAY ONCE FOR SW + NOT PAY FOR EACH TIME SW USED ON WORKSTATION.  
BECOMES VERY EXPENSIVE. RESPONDENT NOW REFUSES TO SIGN SW LICENCES.

Re. PROTOCOLS - LAN is only small part of telegraphic system.  
PABX usage & standard of PTT architecture will have more relevant impact.  
Re LAN: need to sort out problems of do, filing & document administration & archiving

3.

a) How many software development programmers do you employ?

35,000~~00~~ Programmers ie CODE & ANALYSE

b) How many development m/c's do you have?

VAX x 40      INTEL MDS x 250      own m/c FOR PROCESSING  
IBM 3080 & 3083.      CII HB x ?

c) What is the approximate total spent on software development per annum?

1.2 million (million? check.) ON SW ENVIRONMENT &  
PROGRAMS

d) Do you subcontract software development work to third parties?

YES.

e) If so, what proportion of the above is subcontracted?

10-15%.

Have 2 types of s/w ① PGS - service o/s  
 ② PEO - applications

- 4 -

# SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification		PGS 40%	← relates to importance of developer S/w which evolved	Can be
Design		PGS 10%		
Programming	PGS 20%	PGS 80%	PGS 10%	/
Construction		PGS 20%		
Documentation				
Verification				
Operation		PGS 20%		

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

30% ~~the~~ on average - Depends on program complexity, volume, + human factors (very important) - the pace of work varies very much on a regional basis.

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity at a local level ☒
- b) We have attempted to do this ☐
- c) We would like to ☐
- d) We do not measure it ☐

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related	✓	Re Quality Measure re.
Time Related	✓	Maintainability after sales.
Quality Related	✓	Potential for evolving the software.



PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5% maximum which can be expected.

5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

7. Do you or do you intend to use specific languages for program development?

No

Why Not? ① Does not allow for evolution of programs.  
② Leads to problem of modifying the programs  
when s/w is further developed.

Yes

What languages(s) do you use? ③ Do not wish to become dependent on only one s/w manufacturer.

What productivity improvement have you achieved

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

N/A

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No

Why is that? \_\_\_\_\_

Yes

- b) What type of machine(s)? INTEL & IBM + DEC.

- c) What productivity improvement have you achieved?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

N/A It's a question of strategic rather than economy. Aim at improving archive storage + admin.  
Target m/c is not always appropriate.

- d) Are these machines connected in anyway? (eg LAN)

Yes: connect target m/c + compiling m/c +



9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5%	( )	Problems of archiving or database management.
5-14%	( )	
15-25%	( )	
25-49%	30% (maximum could be expected.)	
50-99%	( )	
100% or more	( )	

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX \_\_\_\_\_

Local Area Network Connection (LAN) \_\_\_\_\_

Specific LAN Protocol (eg ETHERNET) \_\_\_\_\_

Other interconnection of document storage & INFOCENTRE

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.  
Use a scale of 10 very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA-2		SUITABILITY FOR APPLICATIONS,
COBOL		Administration
BASIC	easiest	Secretarial
FORTRAN		Lab + scientific
PASCAL		Scientific
ADA	most difficult	for high volumes & complex structures.
C		Unix
CORAL ALGOL Other Languages		

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

There is great need for Language for Specification which would increase productivity + help the implementation of programs. The major issue is the specification/identification of the problem,

12.  
8.

- a) How much have you spent in the last year on specifically increasing programmer productivity?

*GCE group* <sup>parent company GCE Alcatel</sup> 50% of s/w budget — very rough estimate.  
(of which ~~Alcatel~~ is ~~affiliated~~)

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	(1%)	
5-14%	(2%)	
15-25%	(3%)	
25-49%	(5%)	
50-99%	( )	impossible to achieve such an increase
100% or more	( )	After 15% increase of productivity major increases then depend on human factors.

RESPONDENT

: Mr. Chusel

TITLE

: Tech + Strategy Mgr.

COMPANY

: C.I.T. ALCATEL

ADDRESS

: 33, Emerioux.  
Paris

TOTAL REVENUE OF COMPANY for DP.

: 15-16 milliard FF. of which GEM accounts for 350-400 million FF

TOTAL NUMBER OF COMPANY EMPLOYEES

: excluding GSI have 3500 programmers.

4500 among 12 affiliated companies

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

GSI. /TECSI

GSI  
#8

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

GSI is parent co to TESCI.  
 TESCI conducts sw development & engineering.

- 1 -

## TYPE OF S/W DEVELOPMENT

### 1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application

b) Embedded systems? - CONSULTANCY re embedded systems.

Application Type/Product	% of Business	H/W	O/S	Language	APPLICATION
TELECOMMS. TELEPHONE SWITCHING VOICE RECOGNITION ELECTRONIC MAIL	40%	—	—	—	CONSULTING + DEVELOPMENT

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor	GSI O/S	C, PASCAL; PLI DERIVED LISP, PROLOGUE	ARTIFICIAL INTELLIGENCE SIMULATION	
Mini	UNIX O/S	PASCAL	TELECOMMS COMPONENTS i.e. SW ENGINEERING	N/A.
Mainframe	TANDEM O/S PERKIN ELMER	C.		
Other - please specify				



2. FOR OEM BUSINESS ONLY:

a) Do you make engineering changes to the products you buy in?

---

b) Do you attach your own or other manufacturers equipment to your systems?

---

c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:

Markets: 

---

Products: 

---

d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX)  
Window Systems/Operating Environments  
Languages (eg FORTRAN 77, PASCAL)  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price  
Anything else

e) What do you find most restricting about the equipment you are currently marketing as an OEM?

---

---

---

3.

a) How many software development programmers do you employ?

Have CONSULTANTS only - There are 80 at Tecs

b) How many development m/c's do you have?

1X Mini with UNIX      MOTOROLA x ?      MICRO DEVELOPMENT WORK STA  
1X VAX      INTEL x ?      LISA x ?  
MICROS x ?

c) What is the approximate total spent on software development per annum?

100% ie. 43 million FF for Tecs

d) Do you subcontract software development work to third parties?

N/A

e) If so, what proportion of the above is subcontracted?

N/A

# SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

*Emphasis is on Design, analysis & architecture*

Very Important      Important      Neutral      Not Important

Specification	<input checked="" type="checkbox"/>			
Design	<input checked="" type="checkbox"/>			
Programming	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
Construction	<input checked="" type="checkbox"/>			
Documentation	<input checked="" type="checkbox"/>			
Verification	<input checked="" type="checkbox"/>			
Operation	<input checked="" type="checkbox"/>			

- b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

30-40% depending on complexity of project

5. Which of the following statements best fits your position with regard to programmer productivity? *Productivity is project dependent*

a) We measure programmer productivity

☒

b) We have attempted to do this

☐

c) We would like to

☐

d) We do not measure it

☐

If a) or b) or c)

- e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related	<input checked="" type="checkbox"/>	<i>Use subjective judgement.</i>
Time Related	<input checked="" type="checkbox"/>	
Quality Related	<input checked="" type="checkbox"/> <i>Very Important</i>	

PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
( )  
( )

Tend to avoid support s/w,  
would use new language if  
could improve software  
throughput/development by  
using new tools.

7. Do you or do you intend to use specific languages for program development?

No

Why Not? \_\_\_\_\_

Yes

What languages(s) do you use? PASCAL.

What productivity improvement have you achieved

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
( )  
( )

N/A.

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No

Why is that? \_\_\_\_\_

Yes

- b) What type of machine(s)? CROSS-COMPILERS.

- c) What productivity improvement have you achieved?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
( )  
( )

- d) Are these machines connected in anyway? (eg LAN)

No.

Plan to set up one LAN for internal office automation.  
Will develop LAN for clients who are H/W manufacturer  
+ also the French Administration department ie  
army department



9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( ) Not a question of productivity.  
( )  
( ) Need a machine for developing  
( ) S/W for micros  
( )

10. Would you have any specific requirement in connection with the introduction of a new development environment? *Not especially relevant.*

Operating System eg UNIX \_\_\_\_\_

Local Area Network Connection (LAN) \_\_\_\_\_

Specific LAN Protocol (eg ETHERNET) \_\_\_\_\_

Other <sup>1</sup> *Software development on micros.*

11. How would you rate the following languages by the two parameters of *of clients are developing s/w etc for diverse target m/c. Some* Ease of Learning (for professional programmers) and ease of producing *environment* quality s/w. Use a scale of 10 very easy to 1 very hard *are too varied to concentrate on this.*

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
<del>MODULA-2</del>		
COBOL	8-10	Most difficult re s/w quality
BASIC		11; <del>most difficult re</del>
FORTRAN		
PASCAL		
ADA	5-7	8
C		
CORAL ALGOL Other Languages		

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

*In professional environment it's easy to learn more languages*  
*NB Trend towards obsolescence of specialist programs. It's becoming more difficult to recruit staff who are competent in "new" languages etc*

12.  
8. a) How much have you spent in the last year on specifically increasing programmer productivity?

N/A

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

N/A

RESPONDENT

TITLE

COMPANY

ADDRESS

Tech + Strategy  
VINCENT TIXIER  
→ DAVID LLEWELYN  
: KNUT. RIPLEN, Dir. Techniques  
Systems Information  
Software

: GSI - (TECSI)

c/o : 29, Rue des Pyramides  
75001 Paris.

TOTAL REVENUE OF COMPANY

:

TOTAL NUMBER OF COMPANY EMPLOYEES

:

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

Steria

NB

contact yves lemaire

STERIA

#9

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

# TYPE OF S/W DEVELOPMENT

## 1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application

b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor	Bull - DPS 7 & 8	Ulysses (own lang)	Government	impossible to breakdown
Mini	IBM DOS	Sindia "	Transport	
Mainframe	OS <del>QMS</del>	Comptel "in	Banking	
	MUS	PACO	Insurance	
	CICS	for	Petrol	
Other - please specify	TSO	incentes	Administrative sup.	
	DLR	Pascal	Engineering	
		Cobol	H/w Products	
		RPG II & III	CAD & CAD O.	
			marine	

Fortran  
Unix

Consultancy  
Videotex



2. FOR OEM BUSINESS ONLY:

a) Do you make engineering changes to the products you buy in?

---

b) Do you attach your own or other manufacturers equipment to your systems?

---

c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:-

Markets: 

---

Products: 

---

d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX)  
Window Systems/Operating Environments  
Languages (eg FORTRAN 77, PASCAL)  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price  
Anything else

e) What do you find most restricting about the equipment you are currently marketing as an OEM?

---

---

---

3.

a) How many software development programmers do you employ?

1250 personnel incl 950 engineers.  
70 persons in experimental centre for SW at Toulouse

b) How many development m/c's do you have?

IBM for tests no matter what target machine.  
3x IBM MIF, 3x Mini 6 Solar 2x Vax 6080 DP8 7.x1 + workstation

c) What is the approximate total spent on software development per annum?

20 million FF in 1983/1984 - in investment phase

d) Do you subcontract software development work to third parties?

Yes but mainly internal to Steria organisation

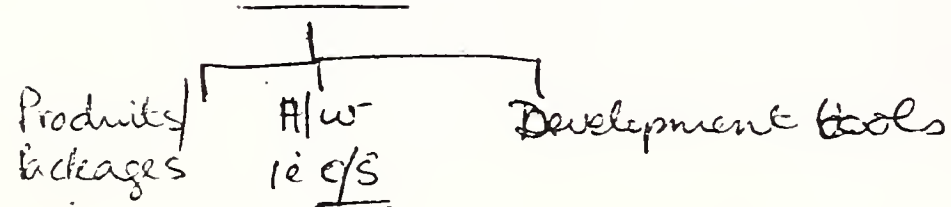
e) If so, what proportion of the above is subcontracted?

Depends on competence. Sometimes inter-Steria groups (affiliates).

### Organisation

350 <sup>persons</sup> in 6 units <sup>eg</sup> industrial sectors.  
n/w. (networks)  
telecomms.  
distribution (S.T. inter)  
transport engineering (ET engine)  
Research + Devel (SRD)  
(CAO)  
Steria products (STR) - SW only.

### CPPL



SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification <i>40% of costs</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Programming <i>40% of costs</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Construction <i>20% costs.</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verification	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

40% of costs.

5. Which of the following statements best fits your position with regard to programmer productivity?

a) We measure programmer productivity

☒

b) We have attempted to do this

☐

c) We would like to

☐

d) We do not measure it

☐

If a) or b) or c)

- e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related	<input checked="" type="checkbox"/>	
Time Related	<input type="checkbox"/>	
Quality Related	<input checked="" type="checkbox"/>	<i>use sophisticated tools for measurement</i>

PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
(X)  
( )

no specific idea  
~~Have~~ Have to evaluate  
new language on different  
basis.  
Expect at least.

7. Do you or do you intend to use specific languages for program development?

No

Why Not? \_\_\_\_\_

Yes

What languages(s) do you use? \_\_\_\_\_

Stevia language:

What productivity improvement have you achieved

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
( )  
( )

~~Pres~~ Very important  
3-4 times faster.

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No

Why is that? \_\_\_\_\_

Yes

- b) What type of machine(s)? Micro eg Micro or IBM p.c.

- c) What productivity improvement have you achieved?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
( )  
( )

Linked to language (above Q7.)  
These machines structure  
programs to aid productivity

- d) Are these machines connected in anyway? (eg LAN)

Yes. Transpac (LAN.)



9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5%	( )	<i>At least save 50% of time.</i>
5-14%	( )	
15-25%	( )	
25-49%	( )	
50-99%	(x)	
100% or more	( )	

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX \_\_\_\_\_

Local Area Network Connection (LAN) Transpac.

Specific LAN Protocol (eg ETHERNET) \_\_\_\_\_

Other *Depends on markets eg USA vs a vs France.*

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.  
Use a scale of 10: very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
<i>Modula-2</i>		
COBOL	<i>most widely used</i>	
BASIC		
FORTRAN		
PASCAL	<i>for 'telematique' products</i>	
ADA		
C		
CORAL ALGOL Other Languages		

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

*Knows Modula. If choice between Ada, Pascal & Modula - would choose "C".*

12.  
8.

- a) How much have you spent in the last year on specifically increasing programmer productivity?

Do not separate. Generally look for tools to improve overall productivity

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

N/A.

Future markets — languages of 4th generation i.e. LISP will be more popular than languages such as LISP.

RESPONDENT

M. Delannoy.  
: Mme de la Haye

TITLE

: Resp du logiciel-Marketing

COMPANY

: Steria

ADDRESS

: 26, Av. de L'Europe.  
78140 Vélizy-Villacoublay.

TOTAL REVENUE OF COMPANY

: (1982) 387 \$55 million

TOTAL NUMBER OF COMPANY EMPLOYEES

: 1982. 1250

of which 950 engineers

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

Yves Lemaire

3, Chemin de la Cépère  
Toulouse 31000

Toulouse

61/ 44 89 89.

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST.

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

TYPE OF S/W DEVELOPMENT

1. Class of Business

DIVISION OF DEFENCE + CONTROL SYSTEMS (SDC)

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application
Defence	25%	Do not <u>sell</u> OEM. <u>buy in</u> OEM.			although
Air Traffic Control	25%				
Marine	25%				

b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language
RADAR - DISPLAY - PLOTTER - EXTRACTORS	DO NOT SEPARATE 90% of business is exports 10% is in France + locally	VAX		Pascal eventually ADA

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor	own E/S RTOS - Real time ops. ops of MITRA	PASCAL + eventually ADA.	AIR TRAFFIC CONTROL FLIGHT PLAN PROCESSING	90% is <u>EXPORTED</u>  10% STAYS IN FRANCE.
Mini	Data General ops DEC - VAX ops 11-780 ops			
Mainframe	DEC 68000 ops	FORTRAN LIR (LANGUAGE) REAL TIME ↓ then ADA.	DEFENCE RADAR SONAR etc	
Other - please specify				



2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?  
Yes. But do not touch c/s.  
Simply add specialised couplers + peripherals.

- b) Do you attach your own or other manufacturers equipment to your systems?  
Only attach own equipment

- c) Are you looking for new OEM opportunities either in terms of markets or products? YES.

Please give indication of what these are:

Markets: EXPORT Markets especially ~~USA~~

Products: "Home-grown" French "mainframe/minis."  
Do not wish to use American products.

- d) Do you have any specific criteria for new OEM products?

Operating System (eg UNIX) v. interesting for spc development on host m/c  
Window Systems/Operating Environments important But N/A to Thompson  
Languages (eg FORTRAN 77, PASCAL) Pascal + Ada for real time, scientific calc  
LAN protocols (eg ETHERNET) + database manipulation  
Response time essential that should be fast - millisecond response. no preference - await market offerings  
Graphics (eg Resolution, Colour) No only use internally  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of) Speed of generating code is v. important  
Price thus use Pascal + Ada  
Anything else no

have own internal protocols. → } None of these are critical

- e) What do you find most restricting about the equipment you are currently marketing as an OEM?

The operating systems for real time operations have not been optimised. This is understandable since the market for such systems is limited.

3.

a) How many software development programmers do you employ?

250 in SDC division.

b) How many development m/c's do you have?

20 - some are specialised & others are for common use

c) What is the approximate total spent on software development per annum?

100 - 150 million FF.

d) Do you subcontract software development work to third parties?

Yes.

e) If so, what proportion of the above is subcontracted?  $33\frac{1}{3}\%$

Associate companies of the Thomson group eg Sysec  
Also use outside companies such as Steria,  
Cap Gemini Sogeti & often <sup>have</sup> ~~exchange~~ personnel  
~~between~~ exchange with these companies.

# SOFTWARE DEVELOPMENT PRODUCTIVITY

- 4 -

NB. Priorities differ according to commercial + industrial products

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification <i>20% of project time</i>	✓			
Design		✓		
Programming <i>40% of project time</i>		less important		✓
Construction <i>Very time consuming for Real Time</i>	✓			
Documentation <i>NB do not provide "packaged" s/w</i>		Quite important		
Verification	✓			
Operation	✓			

- b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

*Programming ≈ 20% but test times vary & can be very long for real time s/w*

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☐
- c) We would like to ☐
- d) We do not measure it ☒

If a) or b) or c)

- e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related		
Quality Related		



PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( ) Measure according to how structured  
( ) easily understood and easily  
( ) maintained the language is  
( )  
( ) Prefer Ada standards and q.s. &

7. Do you or do you intend to use specific languages for program development?

No

Why Not? \_\_\_\_\_

Yes ✓

What languages(s) do you use? PASCAL + ADA.

What productivity improvement have you achieved

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( ) Are more interested in quality of  
( ) personnel & environment, and  
( ) portability of languages &  
( ) consequently staff mobility between  
( ) projects.  
( ) Need more standardisation of s/w languages.

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No ✓

Why is that? It's more effective to use the same m/c

Yes

- b) What type of machine(s)? \_\_\_\_\_

- c) What productivity improvement have you achieved?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
( )  
( )

- d) Are these machines connected in anyway? (eg LAN)

No



9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5% ( )  
 5-14% ( )  
 15-25% ( )  
 25-49% ( )  
 50-99% ( )  
 100% or more ( )

N/A.

Prefer to use  
 same m/c. as target  
 m/c

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX

Unix

Local Area Network Connection (LAN)

Yes if available in market at reasonable price.

Specific LAN Protocol (eg ETHERNET)

Neutral - depends on the service + price

Other User friendly

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.

Use a scale of 10-very easy to 1 very hard

Very dependent on the application

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA-2		
COBOL		
BASIC		
FORTRAN		
PASCAL		Good for Real Time   program of shortage of dp. personnel who know Pascal.
ADA		Good for Real Time
C		
CORAL		
ALGOL		
Other Languages		

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

12.

8.

- a) How much have you spent in the last year on specifically increasing programmer productivity?

*No specific products but continually improve the environment and spend approx 1 million FF on this.*

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%

( )

5-14%

( )

15-25%

( )

25-49%

( )

50-99%

( )

100% or more

( )

*would be prepared to spend 5-10 million FF for 25-50% increase*

*Cannot evaluate in above terms because productivity increases are <sup>part of</sup> ongoing situation.*

*Feels more emphasis should be placed on VERIFICATION / SPECIFICATION / TOOLS ADAPTED FOR PROJECT ORGANISATION AND CONTROL OF PROJECT STAGES*

RESPONDENT

: Mr. DE BARBEYRAC.

TITLE

: DEPUTY TECHNICAL MANAGER OF THOMSON CSF SDC DIVISION

COMPANY

: THOMSON CSF

ADDRESS

: 40, RUE GRANGE DAME ROSES  
MEUDON LA FORÊT

TOTAL REVENUE OF COMPANY

: Not available

TOTAL NUMBER OF COMPANY EMPLOYEES

: ~ 7

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

*Re new software languages - note importance of*

① *CREDIBILITY of the company providing the sw.*

② *PORTABILITY of the sw*

③ *Worldwide application of new languages.*

*Does not feel that language which bridges the gap between say Pascal & Ada is a viable business proposition*

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB



## TYPE OF S/W DEVELOPMENT

### 1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

#### a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application
BANKING. WHOLESALE DISTRIBUTION MEDICAL & REAL ESTATE	70% 20% 10%	25%	0%	5%	70%

OEM activity = 25% of company operations

#### b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language	APPLICATION
MEDICAL.	5% (mainly in OEM area.) ie 5% of total 25% of business activity	45%	0%	5%	55%

#### c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor	MANUFACTURERS O/S eg.	ASSEMBLY	"BLACK BOXES"	5%
Mini	IBM & C.I.T.H.B.	COBOL. ELCAT G (4th generation) P.X	NETWORKS.	55%
Mainframe	ALSO SOPRA O/S.	COBOL + COBOL GENERATORS. SOPRA SW. MEDIUM	SPECIFIC SOFTWARE.	35%
Other - please specify TERMINALS		ASSEMBLY	BANKING	5%



2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?  
YES. ITS PROFITABLE IN THAT CHARGE 10% - 15% OF OEM END PRODUCT COST FOR MAINTENANCE.
- b) Do you attach your own or other manufacturers equipment to your systems?  
YES: ADD OWN & OTHER MANUFACTURERS' EQUIPMENT.
- c) Are you looking for new OEM opportunities either in terms of markets or products? NO. ARE CONCERNED WITH CONSOLIDATING CURRENT MARKET ACTIVITIES.  
 Please give indication of what these are:

Markets: \_\_\_\_\_

Products: \_\_\_\_\_

- d) Do you have any specific criteria for new OEM products?

Operating System (eg UNIX)	UNIX FOR MICROCS PX & MIMS
Window Systems/Operating Environments	NO INTEREST. JUST A GIMMICK
Languages (eg FORTRAN 77, PASCAL)	NO. USAGE = PASCAL 5%. BASIC 15%. ASSEMBLY: COBOL 60%.
LAN protocols (eg ETHERNET)	HAVE TO BE CUSTOMISED NO STANDARD NEEDS. SOPRA SET OWN PROTOCOL
Response time	OFTEN ALTER SYSTEMS TO INCREASE RESPONSE TIME
Graphics (eg Resolution, Colour)	DO NOT USE. BUT IT IS A VIABLE COMMERCIAL FEATURE
Mouse	NO INTEREST
Printing	See *
Memory Size	" "
Disk Storage	VERY IMPORTANT. MUST INCREASE CAPACITY + PRICE PERFORMANCE
Software Development (eg Speed of)	IS VERY COSTLY PART OF SYSTEM. USED LOW COST HIGH STORAGE WITH COMPACT SW - IBM IS doing compo with such a product
Price	DIFFICULT TO EVALUATE. SEE **
Anything else	NOT IMPORTANT. REUSABILITY OF SW IS RELEVANT. ALSO THE SIMILARITY BETWEEN NEW + PREVIOUS PRODUCTS IS DESIRABLE TO ENSURE EFFICIENT USE OF PREVIOUS + NEW SW

- e) What do you find most restricting about the equipment you are currently marketing as an OEM?

Problems re training staff on new equipment. Need to maximise resources & do not want to have to train new staff.  
There is a limited number of people available who have been trained on the new equipment.

- \* MOUSE: LISA is a fine machine but is directed at wrong target market. Problem of gap between market demand & state of the art products
- \* SOFTWARE DEVELOPMENT: Have 2 groups for s/w development. One group deals with classic languages & structured programmes while the second group uses high level languages for Sepva's own s/w products. The second group is based at a "software plant" and concentrates on complex, risky problems & aspects of quality control.
- These 2 groups have similar productivity levels but the products differ enormously in (the programs') quality.

3.

a) How many software development programmers do you employ?  
 600 of which 150 are in R&D plants. Definition of programmer is different in France. Thus have 100 coders

100 systems analysts + consultants  
 400 analysts.

b) How many development m/c's do you have?

Service Bureau m/c x 3 - have shared time for development

Honeywell DPS 7 x 2

DEC VAX x 2 measure approx 5 minis permanently in

CIT HB 7700 x ?

MINI 6

use but there are additional "non-permanent"

CIT HB Mini 6 x 7

SOLAR

SENS

minis for OEM development for clients,

c) What is the approximate total spent on software development per annum?

150-200 million FF.

[SW development = 90% of company activity + provides 65% of the total R&D]

d) Do you subcontract software development work to third parties?

No

e) If so, what proportion of the above is subcontracted?

No.

Le definitions of programmer:

USA — programmer conducts analysis + coding

France — programmer only codes..



SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification	<input checked="" type="checkbox"/>			
Design	<input checked="" type="checkbox"/>			
omitted ARCHITECTURE	<input checked="" type="checkbox"/>			
Programming				<input checked="" type="checkbox"/>
Construction	<input checked="" type="checkbox"/>			
Documentation		Quite important		
Verification		Quite important		
Operation		Quite important		

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

20-25%

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity

☐
- b) We have attempted to do this

☐
- c) We would like to

☐
- d) We do not measure it

☒

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related	N/A.	
Time Related		
Quality Related		

PRODUCTIVITY: Respondent feels that programming is not major area for improving productivity. Every stage is a major influence on productivity. More emphasis on construction method of "eliminating" the project i.e. construction stage.

PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%	( )	N/A re concept of using Pascal
5-14%	( )	modification or similar languages
15-25%	( )	eg. modula 2.
25-49%	( )	Expect up to 90% improvement with
50-99%	( )	3rd generation <del>languages</del> <sup>sw</sup> , and 100-500%.
100% or more	( )	improvement with 4th generation <del>languages</del> <sup>sw</sup> .

7. Do you or do you intend to use specific languages for program development?

No

Why Not? \_\_\_\_\_

Yes ✓

What languages(s) do you use? 4th generation sw re PX.  
(definitely not Cobol or Pascal)

What productivity improvement have you achieved

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	(✓) 400% with PX (This compares with 30% approx using Cobol.)

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No

Why is that? ② Need portability for cross generation of S/W.

Yes ✓

⑤ Resources for operation and development are different.

b) What type of machine(s)? CIH <sup>house</sup> and DEC VAX

c) What productivity improvement have you achieved?

Less than 5%	( )	Have not monitored productivity.
5-14%	( )	
15-25%	( )	<sup>NOTE</sup>
25-49%	( )	Anyway, "productivity is not a
50-99%	( )	directly related to the equipment used"
100% or more	( )	Respondent considers productivity is
	( )	more dependent on the languages used.

d) Are these machines connected in anyway? (eg LAN)

Not yet.



9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5% *see note to 8* *Do not intend to use micros for a long time. Have "unintelligent" (dumb) terminals connected to minis.*  
 5-14% *N/A* *Feels that there is high risk if use micros due to problems of multi-users & tendency to crash very quickly.*  
 15-25% *( )*  
 25-49% *( )*  
 50-99% *( )*  
 100% or more *( )*  
*Also micros cannot handle a sufficient quantity of terminals for sw development*

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX *Need standard sw o/s.*  
 Local Area Network Connection (LAN) *prefer "specific/customised" connections*  
 Specific LAN Protocol (eg ETHERNET) *interested but no specific requirements.*  
 Other

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.  
 Use a scale of 10 very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
<i>MODULA-2</i>		
COBOL	5	5
BASIC	8	3
FORTRAN	6	5
PASCAL	3	6
ADA	1	7
C	3	6
CORAL ALGOL Other Languages	10	8

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

12.  
8.

- a) How much have you spent in the last year on specifically increasing programmer productivity?

2 million FF. (This could increase to 5 million quickly. Have special department with 6 staff (soon to be increased) who deal with methods, tools, quality control, and new languages.)

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )	Depends on priorities eg if need to react to <sup>new</sup> competitive products.
5-14%	( )	
15-25%	( )	
25-49%	( )	
50-99%	( )	
100% or more	( )	Generally allocate 33 1/3 % of total R & D budget.

N/A.

RESPONDENT

: Mr. PAUL CHARIGNON

TITLE

: DIRECTOR OF MARKETING + DEVELOPMENT.

COMPANY

: SOPRA.

ADDRESS

: 90, RUE DE FLANDRES  
PARIS 19.

TOTAL REVENUE OF COMPANY

: \_\_\_\_\_

TOTAL NUMBER OF COMPANY EMPLOYEES

: \_\_\_\_\_

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

Send copy of this qnr. to Mr. Charignon for his records.

*Cap Gemini Sogeti*

CAP-  
GEMINI  
#12

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

# TYPE OF S/W DEVELOPMENT

## 1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application

b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor Mini Mainframe Other - please specify	<u>ALL</u> AVAILABLE O/S.	<u>ALL</u> AVAILABLE LANGUAGES.	TELEPHONE SYSTEMS {SPACE PROJECTS {ROCKETS INDUSTRIAL S/W CUSTOMISED S/W FOR PRODUCTION & ADMINISTRATION	40% in financial/ commercial sector.

98% of company operations <sup>is</sup> consultancy.



2. FOR OEM BUSINESS ONLY:

a) Do you make engineering changes to the products you buy in?

\_\_\_\_\_

b) Do you attach your own or other manufacturers equipment to your systems?

\_\_\_\_\_

c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:

Markets: \_\_\_\_\_

Products: \_\_\_\_\_

d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX)  
Window Systems/Operating Environments  
Languages (eg FORTRAN 77, PASCAL)  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price  
Anything else

e) What do you find most restricting about the equipment you are currently marketing as an OEM?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3.

a) How many software development programmers do you employ?

1800 engineering & programming.

b) How many development m/c's do you have?

Approx 50% are programmers ie 900  
None - work onsite at clients' offices

c) What is the approximate total spent on software development per annum?

None - do not develop sw for general marketplace  
sw development is conducted for clients or paid by  
the clients

d) Do you subcontract software development work to third parties?

No - ITS FORBIDDEN.

e) If so, what proportion of the above is subcontracted?

NONE.

Our research reveals that ORGANISATION, ADMINISTRATION & DESIGN of projects can account for 70% of time spent on a project & are the areas which will cause a project to exceed the schedule deadlines if they are not handled efficiently.

SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

Overall  
guideline  
70%  
project  
time  
on  
specification  
20%  
project  
time  
on  
realisation  
- design  
- program  
- construction  
- doc.  
- Verif.  
- operatn  
- admin  
- organisn

	Very Important	Important	Neutral	Not Important
Specification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Programming	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Construction	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Have designed tools to speed up development productivity: DESIGN - MAI  
Verif., program  
methods + rules  
input + rules  
of processing.

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

50%

ORGANISATION -  
"SCOPE"  
ADMIN -  
"SUPER"

Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☐
- c) We would like to ☐
- d) We do not measure it ☒

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related		
Quality Related		

Most  
important  
aspect of  
Productivity



PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( ) Productivity not so relevant as  
( ) MAINTAINABILITY of S/W, and the S/W  
( ) Structure and the potential for  
( ) S/W evolution.  
( )

Tools for improving specification +  
design are most important.

7. Do you or do you intend to use specific languages for program development?

No

Why Not? \_\_\_\_\_

Yes

What languages(s) do you use? \_\_\_\_\_

FORTRAN for scientific applications  
PASCAL " mathematical "  
A.P.L.

What productivity improvement have you achieved

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( ) Do not measure in terms of  
( ) productivity. The final  
( ) result in terms of Quality +  
( ) Maintainability is more relevant  
( )

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No

Why is that? work at clients' location

Yes

- b) What type of machine(s)? \_\_\_\_\_

- c) What productivity improvement have you achieved?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
( )  
( )

- d) Are these machines connected in anyway? (eg LAN)



9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5% ( )  
 5-14% ( )  
 15-25% ( )  
 25-49% ( )  
 50-99% ( )  
 100% or more ( )

N/A.

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX

UNIX or MS DOS or CICS

Local Area Network Connection (LAN)

COST IS

Specific LAN Protocol (eg ETHERNET)

PROHIBITIVE

Other PORTABILITY.

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.

Use a scale of 10 very easy to 1 very hard

VERY dependent on APPLICATION.

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA-2		
COBOL	most widely used language.	
BASIC	Useless for industrial applications.	
FORTRAN	Respondent uses Fortran mainly because need access to scientific libraries + Fortran is the most language in which the relevant mathematical information is written.	
PASCAL Use a little		
ADA		
C		
CORAL		
ALGOL		
Other Languages	PLA, LTR, PROLOGUE, HSP	

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

Use. COBOL.

12.  
8. a) How much have you spent in the last year on specifically increasing programmer productivity?

N/A.

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

N/A.

RESPONDENT

: Mr. C. P. DENIAUD

TITLE

: DIR. ORGANISATION ET METHODES

COMPANY

: CAP GEMINI SOGETI

ADDRESS

: 92, Bd du MONPARNAISSE  
75682 PARIS CEDEX 14.

TOTAL REVENUE OF COMPANY

: ~~Not available~~ 1982: 1027 million FF.

TOTAL NUMBER OF COMPANY EMPLOYEES

: 3995 million.

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

Claude  
also Mr. Chiabrande.  
Responsable de Formation  
Interne.

*Brig. Film* **BRIGITTA-  
ELWERATH  
#13**

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

TYPE OF S/W DEVELOPMENT

1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application

b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor	MSDoS	Basic	tests	6
Mini	DEC OS	Fortr.	technic.app	14
Mainframe	MVS DOS	PL1 Cob	commerc.	80
Other - please specify				



2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?

---

- b) Do you attach your own or other manufacturers equipment to your systems?

---

- c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are: - .

Markets: \_\_\_\_\_

Products: \_\_\_\_\_

- d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX)  
Window Systems/Operating Environments  
Languages (eg FORTRAN 77, PASCAL)  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price  
Anything else

- e) What do you find most restricting about the equipment you are currently marketing as an OEM?

---

---

---

3.

a) How many software development programmers do you employ?

appr. 45

---

b) How many development m/c's do you have?

2 IBM PC

---

c) What is the approximate total spent on software development per annum?

appr. 3 Mio DM

---

d) Do you subcontract software development work to third parties?

occasionally, not in the last time

---

e) If so, what proportion of the above is subcontracted?

max. 15%

---

SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Programming	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Construction	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Verification	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

appr. 65%

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☐
- c) We would like to ☐
- d) We do not measure it ☒

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related		
Quality Related		

PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%	( )
5-14%	( )
15-25%	( X )
25-49%	( )
50-99%	( )
100% or more	( )

7. Do you or do you intend to use specific languages for program development? for program development NATURAL will be used.

No Why Not? \_\_\_\_\_

Yes

What languages(s) do you use? \_\_\_\_\_

What productivity improvement have you achieved

Less than 5%	( )	
5-14%	( )	no figures available
15-25%	( )	advantages in specifications, mask design
25-49%	( )	prototyping, mask connections
50-99%	( )	while designs rules will be considered as
100% or more	( )	too long in Natural, however of central importance: data dictionary

disadvantage: no linking with Natural

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No Why is that? used Natural runs on own mainframe  
in connection with DRTs.

Yes

b) What type of machine(s)? \_\_\_\_\_

c) What productivity improvement have you achieved?

Less than 5%	( )	
5-14%	( )	documentation:
15-25%	( )	trend to paperless procedures
25-49%	( )	within programs in connection with
50-99%	( )	Natural data dictionary.
100% or more	( )	

d) Are these machines connected in anyway? (eg LAN)

\_\_\_\_\_



9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5%	( )	no program procedures must be seen in
5-14%	( )	planned micro to mainframe connections
15-25%	( )	situation is in study stage now, no
25-49%	( )	results.
50-99%	( )	
100% or more	( )	

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX \_\_\_\_\_

Local Area Network Connection (LAN) \_\_\_\_\_

Specific LAN Protocol (eg ETHERNET) under evaluation but not in connection with program developm.

Other \_\_\_\_\_

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.  
Use a scale of 10=very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA-2		
COBOL	5	5
BASIC		
FORTRAN	6	7
PASCAL		
ADA		
C		
CORAL ALGOL Other Languages		

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented). no valid answers, because results are personell dependend.

9. a) How much have you spent in the last year on specifically increasing programmer productivity?

n.a-

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )	the question is how to move programming
5-14%	( )	activities to the users via DBMS
15-25%	( )	and PC programming instead of increasing
25-49%	( )	central productivities, change of progra
50-99%	( )	language must be seen in connection with
100% or more	( )	this trend change.

RESPONDENT

: Dr. Reiwer

TITLE

: Manager Software Development

COMPANY

: Brigitta-Elwerath, Betriebs-Gesl

ADDRESS

: Riethorst 12

3000 Hannover 51

TOTAL REVENUE OF COMPANY

:

TOTAL NUMBER OF COMPANY EMPLOYEES : 4.000 (total Group)

Contacted DP-Center works for a group of petrol, mining and gas companies in Lower-Saxony.

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

HM HAMBURG-  
MANNHEIMER  
VERSICHERUNG  
#14

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

TYPE OF S/W DEVELOPMENT

1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application

b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor	MSDOS	Basic	Grafic demon-	3
Mini	—		strations,	
Mainframe	IBM	PL 1 90%	Design of prog.	
Other -		Cobol 10%	to support sales	97%
please specify			org.	
			all comm. 1)	
			insurance app.	

program bibliothek consists of 7000 - 8000 programs, first started 15 years ago.



2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?

---

- b) Do you attach your own or other manufacturers equipment to your systems?

---

- c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:

Markets: 

---

Products: 

---

- d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX)  
Window Systems/Operating Environments  
Languages (eg FORTRAN 77, PASCAL)  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price  
Anything else

- e) What do you find most restricting about the equipment you are currently marketing as an OEM?

---

---

---

3.

a) How many software development programmers do you employ?

140

---

b) How many development m/c's do you have?

program development in on-lin operation by CRTs

---

2 IBM PC for PC program development

---

c) What is the approximate total spent on software development per annum?

appr. 12 Mio DM incl. purchased standard packages

---

d) Do you subcontract software development work to third parties?

yes

---

e) If so, what proportion of the above is subcontracted?

under 10%

---

SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification	X			
Design		X		
Programming			X	
Construction			X	
Documentation			X	
Verification		X		
Operation		X		

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

70% separation to design is sometimes difficult

60% Progr. Comp.test, 20%Spec.Design, 20% Documentation

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☐
- c) We would like to ☐
- d) We do not measure it ☒

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related		
Quality Related		

PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%	( )	no new language is considered in trad.
5-14%	( )	mainframe programming, PL 1 is long
15-25%	( )	time introduced, very experienced program
25-49%	( )	change of language would cut more pro-
50-99%	( )	ductivity as could be added by better
100% or more	( )	language

1)

7. Do you or do you intend to use specific languages for program development?

No                      Why Not? \_\_\_\_\_

Yes  
What languages(s) do you use? in use ROSCOE as tool

What productivity improvement have you achieved

Less than 5%	( )	no specific language, bad experience
5-14%	( )	with cross compilers, troubles by change
15-25%	( )	of mainframe OS-releases, even problems
25-49%	( )	to run Siemens PL 1 against IBM PL 1.
50-99%	( )	
100% or more	( )	

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?                      for user applic.

No                      Why is that? company bought 1200 CRTs, on-line programming will be considered as the most eff. way.

Yes ~~Company-even-has-a~~ Company even has a critical position against programming tools, no prove that more efficient but advantages related to auditing and documentation

- b) What type of machine(s)? \_\_\_\_\_

- c) What productivity improvement have you achieved?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

- d) Are these machines connected in anyway? (eg LAN)
- \_\_\_\_\_



9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5%	( )	n.a. major change in programming
5-14%	( )	techniques will be seen in the penetrat
15-25%	( )	of micro computers. The time of huge
25-49%	( )	on-line systems is gone. If as in the
50-99%	( )	given case 1000 on-line users can call
100% or more	( )	up nearly 100 different TP-programs,
		internal system time and waiting time
		is so high, that the procedure becomes

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX uneconomical.  
data bases will be transferred  
in new systems to decentral PCs  
 Local Area Network Connection (LAN) \_\_\_\_\_  
 Specific LAN Protocol (eg ETHERNET) X

Other program development of the future will be done more and more by users, new program techniques connected with LANs but carried out on the used desktop device must be designed.

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.  
 Use a scale of 10 very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA-2		
COBOL		
BASIC		
FORTRAN		
PASCAL		
ADA		
C		
CORAL ALGOL Other Languages PL 1	6	8

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

9. a) How much have you spent in the last year on specifically increasing programmer productivity? internal seminars, external teaching seminars, no figures available
- 

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )	programmer productivity will be considered as high, question of increasing is more question of motivation and cooperation with user departments.
5-14%	( )	
15-25%	( )	
25-49%	( )	
50-99%	( )	
100% or more	( )	

RESPONDENT

Mr Hauffe

TITLE

Manager Dept System Programming

COMPANY

Hamburg-Mannheimer Versicherungs  
AG

ADDRESS

Überseering

2000 Hamburg

TOTAL REVENUE OF COMPANY

TOTAL NUMBER OF COMPANY EMPLOYEES : 2800 in Hamburg headquarter

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

*Logotec*

LOGOTEC  
#15

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

## Information

Logotec is a medium sized german manufacturer of stand alone low cost CAD systems.

Gathering experience with DEC hardware the company switched to an own developed CPU to lower costs. Recognizing that the offered 8 bit systems is too low in performance, though equipped with own speed up device (own arithmetic processor, segment manager for CRT) the company is looking for a new OEM system on MC 68000 base or equivalent, but which could support existing programs written with Pascal Plus.

These parameters seem to me best covered by DISER product. Company wants to get more detailed informations and could be an OEM prospect for the system.

potential quantity orders: 5 - 8 systems per month.



TYPE OF S/W DEVELOPMENT

1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application
CAD	100	Prop.Z-80 Comp.	CP/M	Pascal MD Plus	low cost CAD applic.

b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor				
Mini				
Mainframe				
Other - please specify				

2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?  
MComputer is self engineered
- 

- b) Do you attach your own or other manufacturers equipment to your systems?  
Other Man. CRT, Dig. Tablet, Plotter, Keyboard
- 

- c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:

Markets: \_\_\_\_\_

Products: new 16/32 bit MC with advanced programming languages  
which could pick up old developed Pascal programs.

- d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX) what supports Pascal

Window Systems/Operating Environments X

Languages (eg FORTRAN 77, PASCAL) more modern as Pascal

LAN protocols (eg ETHERNET)

Response time less than 1 sec. on stand alone System

Graphics (eg Resolution, Colour) high re. color

Mouse Digitizer

Printing Plotter

Memory Size - 2 MB

Disk Storage 100 + MB

Software Development (eg Speed of)

Price

Anything else retail price of total system must be below  
DM 100.000

- e) What do you find most restricting about the equipment you are currently marketing as an OEM?

current equipment is prop. not any more state of art, former  
OWM equipment from DEC was too expensive

---

---

3.

a) How many software development programmers do you employ?

6

---

b) How many development m/c's do you have?

5

---

c) What is the approximate total spent on software development per annum?

DM 500.000

---

d) Do you subcontract software development work to third parties?

no

---

e) If so, what proportion of the above is subcontracted?

---

SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Programming	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Construction	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Verification	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

60% (estimation), no figures available

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☐
- c) We would like to ☐
- d) We do not measure it ☒

If a) or b) or c)

- e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related		
Quality Related		



PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%	( )	
5-14%	(X)	change of language is only indicated
15-25%	( )	when new more powerful processor can be
25-49%	( )	used. Has to seen with hardware change.
50-99%	( )	
100% or more	( )	

7. Do you or do you intend to use specific languages for program development?

No                      Why Not? Problems of cross compilation

Yes

What languages(s) do you use? \_\_\_\_\_

What productivity improvement have you achieved

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No X                      Why is that? computer is own manufactured, low cost

Yes

b) What type of machine(s)? \_\_\_\_\_

c) What productivity improvement have you achieved?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

d) Are these machines connected in anyw y? (eg LAN)

\_\_\_\_\_

9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5%	( )	the question is not to have a separate
5-14%	( x )	programming computer, but a more efficient
15-25%	( )	OEM CPU for the CAD systems offered.
25-49%	( )	
50-99%	( )	
100% or more	( )	

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX 16/32 bit OS what should support  
Pascal add equiv. language  
 Local Area Network Connection (LAN) for future systems  
 Specific LAN Protocol (eg ETHERNET) \_\_\_\_\_  
 Other \_\_\_\_\_

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.  
 Use a scale of 10 very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA-2		
COBOL		
BASIC	6	5
FORTRAN		
PASCAL	5	8
ADA		
C		
CORAL ALGOL Other Languages		

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

9. a) How much have you spent in the last year on specifically increasing programmer productivity?  
n.a.
- 

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )	main question is not to improve programmer productivity but system productivity
5-14%	( )	
15-25%	( )	
25-49%	( )	
50-99%	( )	
100% or more	( )	

RESPONDENT

: Mr. Sölf

TITLE

: Manager Software Development

COMPANY

: Logotec Hardware GmbH

ADDRESS

: Lodenheide 2

D 4010 Hilden

TOTAL REVENUE OF COMPANY

: DM 10 Mio

TOTAL NUMBER OF COMPANY EMPLOYEES :

40

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

ZEDA  
#16

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB



TYPE OF S/W DEVELOPMENT

1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application

b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor	CP/M	Basic, DBMS	commercial	10
Mini WANG	Wang OS	Cobol, RPG	vertical mark.	50
Mainframe	Nidos	Cob. RPG II	"	40
Nixdorf 8890				
Other - please specify				

2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?

\_\_\_\_\_

- b) Do you attach your own or other manufacturers equipment to your systems?

\_\_\_\_\_

- c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are: . . . . .

Markets: \_\_\_\_\_

Products: \_\_\_\_\_

- d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX)  
Window Systems/Operating Environments  
Languages (eg FORTRAN 77, PASCAL)  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price  
Anything else

- e) What do you find most restricting about the equipment you are currently marketing as an OEM?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3.

a) How many software development programmers do you employ?

20

---

b) How many development m/c's do you have?

2 Mcs    1 x Wang VS 90    1x Nixdorf 8890    Access to IBM 3033

---

c) What is the approximate total spent on software development per annum?

2,1 Mio DM incl computer rentals

---

d) Do you subcontract software development work to third parties?

in peak time only

---

e) If so, what proportion of the above is subcontracted?

5 - 10%

---

SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification		X		
Design	X			
Programming		X		
Construction		X		
Documentation			X	
Verification			X	
Operation		X		

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?  
60% but varies related to program complexity

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☒
- c) We would like to ☐
- d) We do not measure it ☒

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related	was tried as the easiest way, but results had to be related to program quality evaluation caused difficulties with programmers	
Quality Related		



PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%	( )	productivity improvement will not be
5-14%	( )	seen in using another language
15-25%	( )	but in the use of programing tools
25-49%	( )	advantages of tools are:
50-99%	( )	- improved documentation
100% or more	( )	- identical design
	( )	- maintenance easy
		- programming procedures are programmer independent, but to work with tools

7. is often more costly and only in some cases less time consuming  
Do you or do you intend to use specific languages for program development?

programmers must be trained, in their individualistic behavior they often refuse to learn new languages  
No x Why Not? Cobol and RPG will be considered efficient, due to long experience of programmers

Yes

What languages(s) do you use? \_\_\_\_\_

What productivity improvement have you achieved

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No X Why is that? target machines (Nixdorf, Wang) are provided on a low cost base. Different machines cause additional expenses

Yes but questions will be evaluated, in case UNIX programming become major part of programming activities, in this case company

- b) What type of machine(s)? needs powerful Unix machine

- c) What productivity improvement have you achieved?

Less than 5%	( )	no figures available
5-14%	( )	
15-25%	( )	
25-49%	( )	
50-99%	( )	
100% or more	( )	

- d) Are these machines connected in anyway? (eg LAN)  
not yet planned

9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5% ( )  
 5-14% ( )  
 15-25% (X) only in case of Unix and if productivity  
 25-49% ( ) can be measured in total.  
 50-99% ( )  
 100% or more ( )

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX Cobol under Unix instead of "C"

Local Area Network Connection (LAN) \_\_\_\_\_

Specific LAN Protocol (eg ETHERNET) \_\_\_\_\_

Other

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.

Use a scale of 10 very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA-2		
COBOL	4	7
BASIC	7	5
FORTRAN		
PASCAL	no experience	
ADA		
X RPG	4	6
CORAL ALGOL Other Languages		

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

9. a) How much have you spent in the last year on specifically increasing programmer productivity?  
figures n.a.
- 

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )
5-14%	( )
15-25%	(7%)
25-49%	( )
50-99%	( )
100% or more	( )

RESPONDENT

: Mr. Krey

TITLE

: Manager Marketing

COMPANY

: ZEDA GmbH

ADDRESS

: Mühlenweg

Wuppertal

TOTAL REVENUE OF COMPANY

: DM 6.Mio Computer Service only

TOTAL NUMBER OF COMPANY EMPLOYEES

: 40 non captive Software included

Total company (Vorwerk Co.) 12.000 empl. 800 Mio DM sales

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB



TYPE OF S/W DEVELOPMENT

1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application

b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language
computerized typesetting system	100	prop.	Unix	Pascal Assembler

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor				
Mini				
Mainframe				
Other - please specify				

2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?

---

- b) Do you attach your own or other manufacturers equipment to your systems?

---

- c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:      -      .

Markets: \_\_\_\_\_

Products: \_\_\_\_\_

- d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX)  
Window Systems/Operating Environments  
Languages (eg FORTRAN 77, PASCAL)  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price  
Anything else

- e) What do you find most restricting about the equipment you are currently marketing as an OEM?

---

---

---

3.

a) How many software development programmers do you employ?

11 (in this dept.) (new development)

---

b) How many development m/c's do you have?

1 DEC System VAX 780 with 10 terminals

---

c) What is the approximate total spent on software development per annum?

appr. 1 Mil DM

---

d) Do you subcontract software development work to third parties?

in special cases

---

e) If so, what proportion of the above is subcontracted?

below 10%

---

Software development will be done on DEC system with compilation to own developed MC 68000 Hardware

New system will be introduced at Imprinta Exhibition in Dusseldorf 22. 2. - 28- 2 1984.

Development manager is available for more detailed conversation after this time.

SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification	X			
Design	X			
Programming		X		
Construction		X		
Documentation (not for customer use) internal only			X	
Verification		X		
Operation	X			

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?  
 35 (high time consumption for design; because of specific graphic and typesetting system)

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☐
- c) We would like to ☐
- d) We do not measure it ☒

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related		
Quality Related	X	



PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	(X )
100% or more	( )

7. Do you or do you intend to use specific languages for program development?

No                      Why Not?      Question of cross compilation program  
   ~~modifications will be considered~~  
   as difficult

Yes

What languages(s) do you use?      Pascal

What productivity improvement have you achieved

Less than 5%	( )	for later projects new more efficient
5-14%	( )	program language will be considered,
15-25%	( )	Modula 2 is known
25-49%	( )	
50-99%	( )	
100% or more	( )	

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No                      Why is that?      AX 780 (DEC)

Yes                      new own hardware is not yet available in tested operation

- b) What type of machine(s)?

- c) What productivity improvement have you achieved?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	(X ) supposed
50-99%	( )
100% or more	( )

- d) Are these machines connected in anyway? (eg LAN)

The DEC system consists of 10 terminals

9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( X )
100% or more	( )

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX X

Local Area Network Connection (LAN) X

Specific LAN Protocol (eg ETHERNET) \_\_\_\_\_

Other \_\_\_\_\_

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.  
Use a scale of 10 very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA-2		
COBOL	4	6
BASIC	7	4
FORTRAN	4	6
PASCAL	6	7
ADA		
C	5	6
CORAL ALGOL Other Languages		

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

9. a) How much have you spent in the last year on specifically increasing programmer productivity?

the installation of the VAX system : appr. 1 Mio DM

---

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )	n.a. depends on future development
5-14%	( )	activities
15-25%	( )	
25-49%	( )	
50-99%	( )	
100% or more	( )	

RESPONDENT

: Dr. Trambacz

---

TITLE

: Man. Product planning

---

COMPANY

: Berthold AG

---

ADDRESS

: Teltowkanalstraße

---

1000 Berlin

---

TOTAL REVENUE OF COMPANY

: appr. 230 Mio DM

---

TOTAL NUMBER OF COMPANY EMPLOYEES

: • 1600

---

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

Berthold AG

Well known german manufacturer of typesetting equipments, phototypesetting, computer typesetting.

Since new system will be introduced, conversion with department manager of software and development was scheduled after Düsseldorf Impinta exhibition, in early March.

Dr. Trambacz, who was the partner in the interview, left the company and now is Professor for Communication and Computer Science at Fachhochschule in Cologne ( per 1.1.1984). Further discussions can be arranged with Mr. Hauber, Product Planning



INPUT QUESTIONNAIRE

CATALOG NO: YDIS

STUDY TITLE: DISER/GENEVEST

TYPE OF QUESTIONNAIRE : MARKET POTENTIAL

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

TYPE OF S/W DEVELOPMENT

1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application
CAD	100	DEC PDP	DEC	Assembler Fortran	Design Engineering

b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor				
Mini				
Mainframe				
Other - please specify				

2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?  
CRT Controller, Enclosure
- 

- b) Do you attach your own or other manufacturers equipment to your systems?  
other man.: Graphic Displays, Plotters
- 

- c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are: -

Markets: \_\_\_\_\_

Products: Advanced stand alone systems

---

- d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX) Unix, also transformation of existing  
Window Systems/Operating Environments programs  
Languages (eg FORTRAN 77, PASCAL) C  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse x  
Printing non impact printing  
Memory Size 1 MB up  
Disk Storage - 200 MB  
Software Development (eg Speed of)  
Price under 100.000 pro stand alone system  
Anything else

- e) What do you find most restricting about the equipment you are currently marketing as an OEM?

too expensive, too slow

---

demand for stand alone systems in CAD

---

Company is in negotiation with Apollo-Domain: high speed system,  
Unix. Vendor grants software support and will develop special  
CAS software

3.

a) How many software development programmers do you employ?  
In Germany: 6

---

b) How many development m/c's do you have?  
1 DEC System PDP 11/70

---

c) What is the approximate total spent on software development per annum?  
appr. 800.000.-DM

---

d) Do you subcontract software development work to third parties?  
yes

---

e) If so, what proportion of the above is subcontracted?  
30%

---

support also from system vendor



SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Programming	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Construction	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verification	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

40 - 50 depends of time for testing

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☐
- c) We would like to ☐
- d) We do not measure it ☒

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related		
Quality Related		

PRODUCTIVITY AIDS

6. a) What level of productivity improvement would persuade you to adopt a new language for development purposes?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( X )

7. Do you or do you intend to use specific languages for program development?

No ☒ Why Not? Company only gives program support to customers

Yes  
What language(s) do you use? Fortran, Assembler

What productivity improvement have you achieved

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

8. a) Do you use a machine (computer or workstation) for program development that is different from the target machine?

No Why is that? DEC system is useful for program development flexibility in customer support, system can be exchanged

Yes

b) What type of machine(s)? \_\_\_\_\_

- c) What productivity improvement have you achieved?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

d) Are these machines connected in anyway? (eg LAN)

\_\_\_\_\_

9. What level of productivity improvement would persuade you to use a separate microcomputer based workstation for program development, or persuade you to adopt this approach more fully?

Less than 5%	( )	
5-14%	( )	
15-25%	( )	
25-49%	( X )	theoretical approach, because company
50-99%	( )	wants to involve OEM system vendor to
100% or more	( )	do programming for standard applications

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System eg UNIX X

Local Area Network Connection (LAN) X

Specific LAN Protocol (eg ETHERNET) \_\_\_\_\_

Other \_\_\_\_\_

11. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) and ease of producing quality s/w.  
Use a scale of 10 very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
COBOL	4	7
BASIC	7	5
FORTRAN	4	7
PASCAL	5	5
ADA		
C		
CORAL		
ALGOL		
Other Languages		
MODULA-2		

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

9. a) How much have you spent in the last year on specifically increasing programmer productivity?  
n,a,

- b) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	(25)
100% or more	( )

RESPONDENT

: Mr. Remmers

TITLE

: Sales Manager

COMPANY

: Racal Redac

ADDRESS

: Seevetal 3

TOTAL REVENUE OF COMPANY

: 8 Mio DM

TOTAL NUMBER OF COMPANY EMPLOYEES

: appr. 30

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

Company offers CAD system and will change from existing DEC base multistation system to less expensive but powerful single station system ( Appollo Domain under consideration, or contract just made)



# BOEING COMPUTER SERVICES

CATALOG NO. ZUK1111

#19

Art Rollins Software and Education Products Group

MARKET POTENTIAL 2810 160th Avenue SE

(Vendor)

Bellview WA 98008

Software & Education Products Group

## TYPE OF SOFTWARE DEVELOPMENT

### 1. Class of Business

See attached

A. Excluding in-house data processing, what type of product software development does your organization undertake?

① DP Professional Support ② Manuf/Engineering

B. OEM? If OEM, please also answer question 2. ③ Computer Based

* Market Segment	Percent of Business	Hardware	Operating Systems	④ Information Language	Instruction Center an Application Office
_____	____%	_____	_____	_____	_____
_____	____%	_____	_____	_____	_____
_____	____%	_____	_____	_____	_____
_____	____%	_____	_____	_____	_____
_____	____%	_____	_____	_____	_____
Total	100%	* CAI products sold on IBM PC & mainframe			

What percent of your overall revenues does this business represent?

\_\_\_\_%

### C. Embedded Systems?

Application Type/Product	Percent of Business	Hardware	Operating Systems	Language
Relational DB BCS-RIM	N/A%	CRAY, IBM	VM TSC	FORTRAN
* System development	N/A%	PC	UNIX	C
_____	____%	_____	_____	_____
_____	____%	_____	_____	_____
_____	____%	_____	_____	_____

What percent of your overall revenue does this business represent?

NA%

\* a "CAD/CAM" approach to system development

### D. Product Software?

<u>Hardware</u>	<u>Operating Systems</u>	<u>Language</u>	<u>Application</u>	<u>Percent of Business</u>
Microprocessor				NA%
Mini Mainframe	VM, MVS, ACP	FORTRAN	MANUF/	NA %
Other (specify)	CMS, TSO	ASSEMBLER	ENG. CAI	%
<b>Total</b>				100 %

What percent of your overall revenue does this business represent?

NA 8/8

2. If OEM only:

A. Do you make engineering changes to product? \_\_\_\_\_

B. Do you attach your own or other manufacturers equipment to your systems?

C. Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of/what these are:

Markets: \_\_\_\_\_/

**Products:** \_\_\_\_\_

PRODUCT	DESCRIPTION	PRICE	NUMBER INSTALLED	CPU REQUIREMENTS (Operating, Systems Software)
Executive Information Service (EIS)	Decision Support System	\$55,000 to \$160,000	N/A	IBM 370 and up (VM, CMS, MVS).
Boeing Intelligent Terminal System (BITS)	Software Family for Microcomputers used as Workstations/Intelligent Terminals	On Request	N/A	IBM PC, Xerox 820, Wang, TRS-80, HP 125, Terak 8510, DEC PDP-11/23 (All use UCSD-P).
Relational Information Management System (RIM)	Relational DBMS	\$ 7,500 (Base System) \$ 2,500 (Report Writer)	60	CDC CYBER (NOS), IBM (MVS, CMS), DEC (VMS), CRAY (COS).
Production Management System (PMS)	Production Management	On Request	N/A	HP 3000 (MPE, IMAGE DBMS).
Maintenance and Materials Management System (MMS)	Plant and Equipment Maintenance System	On Request	N/A	HP 3000 (MPE, IMAGE DBMS).
Financial Accounting System (FACTS)	Accounting and Reporting of EDP Resources	\$ 9,500+	50	IBM 360 and up (MFT, MVT, VS1, VS2, MVS, SVS).
System Analysis and Resource Accounting (SARA)	Computer Performance Measurement	\$14,500	150	HIS Level 66, Series 6000 (GCOS 3, 8)
Transaction Reporting System (TRS)	Data Center Management	\$ 6,950	20	HIS Level 66, Series 6000
Easy5	Simulation and Control Systems Analysis Language	\$60,000	20	CDC CYBER (NOS), IBM (TSO), DEC VAX (VMS), CRAY (COS).
Scholar/Teach 3	Computer-based Instruction	\$35,000 Mainframe \$45,000 ACP \$ 300 PC	30 Mainframe	IBM 370 and up (CMS, IMS, CICS, TSO, ACP TASK/MASTER), IBM PC and 51XX (PC/MS-DOS).

D. Do you have any specific criteria for new OEM products?

Operating System (EG Unix) \_\_\_\_\_  
Window Software \_\_\_\_\_  
Languages (E.G. Fortran 77, Pascal) \_\_\_\_\_  
LAN Protocols (E.G. ethernet) \_\_\_\_\_  
Response Time \_\_\_\_\_  
Graphics (E.G. Resolution, Colors) \_\_\_\_\_  
Mouse \_\_\_\_\_  
Printing (E.g. Laser) \_\_\_\_\_  
Memory Size \_\_\_\_\_  
Disk Storage \_\_\_\_\_  
Application Development (e.g..speed of) \_\_\_\_\_  
Price \_\_\_\_\_  
Other \_\_\_\_\_  
\_\_\_\_\_

E. What do you find most restricting about the equipment you are currently marketing as an OEM?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. A. How many software development programmers do you employ? N/A

B. How many development M/C's do you have? N/A

C. What is the approximate total dollars spent on software development per annum?

\$ N/A



## 3. (Cont.)

D. Do you sub-contract software development work to third parties?

yesE. If so, what proportion of the above is subcontracted? new area

## 4. Software Development Productivity

A. How would you rate the following major elements of software development in terms of their importance to your organization?

\* MOST IMPORTANT

	Very Important	Important	Neutral	Not Important
• Specification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Programming	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Construction	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Documentation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verification	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

B. What percent of the overall development is represented by programming, including compilation and testing of individual modules?

15-20%

5. Which of the following statements best fits your position with regard to programmer productivity?

- A. ☐ We measure programmer productivity
- B. ☐ We have attempted to do this
- C. ☒ We would like to
- D. ☐ We do not measure it

## 5. (Cont.)

If A., B., or C.:

E. How do you measure (or would like to) programmer productivity and what specific units are measured?

	<u>Comment</u>	<u>Specific Unit of Measurement</u>
Cost Related	<i>Each project is different</i> <i>Cannot say since each project is unique and is not repeated</i>	
Time Related		
Quality Related		

## 6. Productivity Aids:

A. What level of productivity improvement would persuade you to adopt a new language for development purposes?

- Less than 5% ☐
- 5-14% ☐
- 15-24% ☐
- 25-49% ☐
- 50-99% ☐
- 100% or more ☒

5:1

7. A. Have you or do you intend to use languages specifically for program development?

☐ Yes, ☒ No, Why Not? *Doesn't see a difference*

B. What language(s) do you use?                     

C. What productivity improvement have you achieved?

- Less than 5% ☐
- 5-14% ☐
- 15-24% ☐
- 25-49% ☐
- 50-99% ☐
- 100% or more ☐

N/A

8. A. Do you use a machine (computer or workstation) for program development, that is different from the target machine?

☐ No ☒ Yes

B. What type of machine(s)? N/A

- C. What productivity improvement have you achieved?

Less than 5% ☐  
5-14% ☐  
15-24% ☐  
25-49% ☐  
50-99% ☐  
100% or more ☐

*Don't measure*

D. Are these machines connected in any way? ☐ No ☒ Yes How?

9. What level of productivity improvements would persuade you to use a separate microcomputer-based workstation for program development?

Less than 5% ☐  
5-14% ☐  
15-24% ☐  
25-49% ☐  
50-99% ☐  
100% or more ☒

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System (e.g., Unix) A new product of ours is UNIX-based

Local Area Network Connection (LAN) \_\_\_\_\_

Specific LAN protocol (e.g., Ethernet) \_\_\_\_\_

Other \_\_\_\_\_

11. How would you rate the following languages by the two parameters of ease of learning (for professional programmers) - Ease of producing quality software.  
(Use Scale 1-10 where 10= very easy, 1 = very hard)

	<u>Relative Ease of Learning</u>	<u>Relative Ease of Producing Quality Software</u>
Cobol		
Basic	<u>3</u> 7	<u>5</u> 5
Fortran	<u>4</u> 6	<u>4</u> 6
Pascal	<u>5</u> 5	<u>2</u> 8
ADA		
C	<u>5</u> 5	<u>3</u> 7
Coral		
Algol		
Modula 2		
Other Languages		

(Note: Do not need to answer for all languages. Qualify software would imply - efficient code, easy to amend and update, easily documented).

12. A. How much have you spent in the last year on specifically increasing programmer productivity?

Confidential

B. What proportion of you overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

	<u>Proportion</u>
Less than 5%	<input type="checkbox"/> _____
5-14%	<input type="checkbox"/> _____
15-24%	<input type="checkbox"/> _____
25-49%	<input type="checkbox"/> _____
50-99%	<input type="checkbox"/> _____
100% or more	<input checked="" type="checkbox"/> <u>25%</u> (in a year)



MCAUTO - CORPORATE

James E. Armstrong. PO BOX 516 St Louis MO 63166

Senior Principal Consultant

Applications Development (Vendor)

Methodologies.

CATALOG NO. ZUK1 #2C

MARKET POTENTIAL

TYPE OF SOFTWARE DEVELOPMENT : Technology Directions - sits  
future directions of where  
company will go  
in new technology  
focusing on develop  
tools and  
methodolog

1. Class of Business

A. Excluding in-house data processing, what type of product software development does your organization undertake?

① application dev. tools ② graphics

B. OEM? If OEM, please also answer question 2.

Market Segment	Percent of Business	Hardware	Operating Systems	Language	Application
_____	_____%	_____	_____	_____	_____
_____	_____%	_____	_____	_____	_____
_____	_____%	_____	_____	_____	_____
_____	_____%	_____	_____	_____	_____
_____	_____%	_____	_____	_____	_____
Total	100 %				

What percent of your overall revenues does this business represent?

\_\_\_\_\_%

C. Embedded Systems?

Application Type/Product	Percent of Business	Hardware	Operating Systems	Language
STRADIS DRAW - GRAPHICS	_____%	Used to have		
_____	_____%	Textrom system - no		longer available
_____	_____%	_____	_____	_____
_____	_____%	_____	_____	_____
_____	_____%	_____	_____	_____

What percent of your overall revenue does this business represent?

\_\_\_\_\_%

## D. Product Software?

<u>Hardware</u>	<u>Operating Systems</u>	<u>Language</u>	<u>Application</u>	<u>Percent of Business</u>
Microprocessor				%
Mini Mainframe	MVS, TSO	FORTRAN	Application	%
Other (specify)	DOS/USE VM/CMS	ASSEMBLER	dev. multiple Report Creation System	%
Total				100 %

What percent of your overall revenue does this business represent?

N/A %

## 2. If OEM only:

A. Do you make engineering changes to product? \_\_\_\_\_

\_\_\_\_\_

B. Do you attach your own or other manufacturers equipment to your systems?

\_\_\_\_\_

C. Are you looking for new OEM opportunities either in terms of markets or products?

\_\_\_\_\_

Please give indication of what these are:

Markets: \_\_\_\_\_

Products: \_\_\_\_\_

D. Do you have any specific criteria for new OEM products?

Operating System (EG Unix) \_\_\_\_\_  
 Window Software \_\_\_\_\_  
 Languages (E.G. Fortran 77, Pascal) \_\_\_\_\_  
 LAN Protocols (E.G. ethernet) \_\_\_\_\_  
 Response Time \_\_\_\_\_  
 Graphics (E.G. Resolution, Colors) \_\_\_\_\_  
 Mouse \_\_\_\_\_  
 Printing (E.g. Laser) \_\_\_\_\_  
 Memory Size \_\_\_\_\_  
 Disk Storage \_\_\_\_\_  
 Application Development (e.g..speed of) \_\_\_\_\_  
 Price \_\_\_\_\_  
 Other \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

E. What do you find most restricting about the equipment you are currently marketing as an OEM?

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

3. A. How many software development programmers do you employ? 300

B. How many development M/C's do you have? none dedicated  
do use VAX, IBM,  
PCs

C. What is the approximate total dollars spent on software development per annum?

\$ unknown

3. (Cont.)

D. Do you sub-contract software development work to third parties?  
not really

E. If so, what proportion of the above is subcontracted? 1

4. Software Development Productivity

A. How would you rate the following major elements of software development in terms of their importance to your organization?

	Very Important	Important	Neutral	Not Important
Specification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Programming	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Construction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verification	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

*taken care of in design phase comes with programming*

*(in relation to other elements)*

B. What percent of the overall development is represented by programming, including compilation and testing of individual modules?  
*depends on time?*

\* 20-30%  
*Programming is dependent quality of specs.*  
*\* Assuming the specs & design were done properly that is where time is spent*

5. Which of the following statements best fits your position with regard to programmer productivity?

- A. ☐ We measure programmer productivity
- B. ☒ We have attempted to do this
- C. ☐ We would like to
- D. ☐ We do not measure it



5. (Cont.)

If A., B., or C.:

E. How do you measure (or would like to) programmer productivity and what specific units are measured?

*Deliverables is unit we measure: How much labor of measurement and material went into it.*

Cost Related

Time Related

Quality Related

*Total output is measured*  
*"Lines of code" does not work.*

6. Productivity Aids:

A. What level of productivity improvement would persuade you to adopt a new language for development purposes?

- Less than 5% ☐
- 5-14% ☐
- 15-24% ☐
- 25-49% ☒
- 50-99% ☐
- 100% or more ☐

*Commercial industry will take longer to accept more government oriented right now are using preliminary ADA compilers.*

7. A. Have you or do you intend to use languages specifically for program development?

☒ Yes, ☐ No, Why Not?

*Yes ADA*

*If they do what they say they will do. Leads itself to structured*

B. What language(s) do you use?

C. What productivity improvement have you achieved?

- Less than 5% ☐
- 5-14% ☐
- 15-24% ☐
- 25-49% ☐
- 50-99% ☐
- 100% or more ☐

*Too new to evaluation*

*design concepts - Very positive Concepts.*

*Problem: existing systems in another languages.*

*What about conversion A major issue,*

*No one knows how to measure productivity really. to evaluate a given language*

8. A. Do you use a machine (computer or workstation) for program development, that is different from the target machine?

☒ No ☐ Yes

B. What type of machine(s)? \_\_\_\_\_

C. What productivity improvement have you achieved?

Less than 5% ☐  
 5-14% ☐  
 15-24% ☐  
 25-49% ☐  
 50-99% ☐  
 100% or more ☐

D. Are these machines connected in any way? ☐ No ☐ Yes How? \_\_\_\_\_

9. What level of productivity improvements would persuade you to use a separate microcomputer-based workstation for program development?

Less than 5% ☐  
 5-14% ☐  
 15-24% ☐  
 25-49% ☒  
 50-99% ☐  
 100% or more ☐

10. Would you have any specific requirements in connection with the introduction of a new development environment? product would have to be transportable

Operating System (e.g., Unix) unknown <sup>possibly</sup> "C" or Ada

Local Area Network Connection (LAN) Yes - the key - necessary

Specific LAN protocol (e.g., Ethernet) own network <sup>but major cost</sup>

Other \_\_\_\_\_

Transportable Product is Necessary

11. How would you rate the following languages by the two parameters of ease of learning (for professional programmers) - Ease of producing quality software.  
(Use Scale 1-10 where 1= very easy, 10= very hard)

	Relative Ease of Learning		Relative Ease of Producing Quality Software	
Cobol	3	7	5	5
Basic	3	7	6	4
Fortran	3	7	8	2
Pascal	4	6	4	6
ADA	4	6	2	8
C	6	4	6	4
Coral	-		-	
Algol	-		-	
Modula 2	-		-	
Other Languages				

(Note: Do not need to answer for all languages. Qualify software would imply - efficient code, easy to amend and update, easily documented).

12. A. How much have you spent in the last year on specifically increasing programmer productivity?  
( So many in company , cannot estimate )

B. What proportion of you overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

	Proportion
Less than 5%	<input type="checkbox"/>
5-14%	<input type="checkbox"/>
15-24%	<input type="checkbox"/>
25-49%	<input type="checkbox"/>
50-99%	<input checked="" type="checkbox"/> 8% our budget
100% or more	<input type="checkbox"/>

*Too tough to say. I don't think it should be a dept thing. Would be a corporate commitment*



Ron Jeffries  
VP

COMSHARE INC. CATALOG NO. ZUK1111  
3001 S. State Street Ann Arbor MI  
MARKET POTENTIAL  
(Vendor)

48106

#2

TYPE OF SOFTWARE DEVELOPMENT

1. Class of Business

A. Excluding in-house data processing, what type of product software development does your organization undertake?

Decision support and data base management

B. OEM? If OEM, please also answer question 2.

Market Segment	Percent of Business	Hardware	Operating Systems	Language	Application
<u>Cross</u>	<u>NA</u> %	<u>TRS</u>		<u>C</u>	<u>Decision support syst</u>
	%	<u>IBM?</u>			
	%	<u>2</u>			
	%	<u>would not comment</u>			
	%				
Total	<u>100</u> %				

What percent of your overall revenues does this business represent?

NA %

C. Embedded Systems?

Application Type/Product	Percent of Business	Hardware	Operating Systems	Language
	%			
	%			
	%			
	%			
	%			

What percent of your overall revenue does this business represent?

       %



## D. Product Software?

<u>Hardware</u>	<u>Operating Systems</u>	<u>Language</u>	<u>Application</u>	<u>Percent of Business</u>
Microprocessor	<u>PC DOS</u>	<u>C</u>	<u>Decision support</u>	<u>% not</u>
Mini Mainframe	<u>VM MVS</u>	<u>C</u>	<u>DB management</u>	<u>% avail</u>
Other (specify)			<u>Decision support</u>	
				<u>%</u>
Total				<u>100 %</u>

What percent of your overall revenue does this business represent?

N/A %

## 2. If OEM only:

A. Do you make engineering changes to product? no

B. Do you attach your own or other manufacturers equipment to your systems?

Certain displays

C. Are you looking for new OEM opportunities either in terms of markets or products?

Yes

Please give indication of what these are:

Markets:

Products:

Confidential

D. Do you have any specific criteria for new OEM products?

Operating System (EG Unix) Not locked into it IBM PC DO.  
but

Window Software Yes

Languages (E.G. Fortran 77, Pascal) "C" but might change  
if better alternative

LAN Protocols (E.G. ethernet) no

Response Time N/A

Graphics (E.G. Resolution, Colors) color; 700x300, at least

Mouse yes

Printing (E.g. Laser) none

Memory Size range depends on the product, but

Disk Storage "yes there is a requirement  
(at least one disk)"

Application Development (e.g. speed of) N/A

Soft. Price PC = \$50-1,000 mainframe = \$100,000

Other —

E. What do you find most restricting about the equipment you are currently marketing as an OEM?

nothing

3. A. How many software development programmers do you employ? 100 US  
30 UK

B. How many development M/C's do you have? U.S. only  
① 4300 - IBM  
② 40-50 IBM PC  
③ 2-3 DEC UNIX

C. What is the approximate total dollars spent on software development per annum?

\$ 5 million

## 3. (Cont.)

D. Do you sub-contract software development work to third parties?

rarelyE. If so, what proportion of the above is subcontracted? < 1 %

## 4. Software Development Productivity

A. How would you rate the following major elements of software development in terms of their importance to your organization?

	Very Important	Important	Neutral	Not Important
Specification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Programming	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Construction	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The way we  
our  
work,  
this phase  
taken  
care of  
in other  
phases

B. What percent of the overall development is represented by programming, including compilation and testing of individual modules?

Estimate = 34 %We don't phase projects this way, however

5. Which of the following statements best fits your position with regard to programmer productivity?

- A. ☐ We measure programmer productivity
- B. ☒ We have attempted to do this
- C. ☒ We would like to
- D. ☐ We do not measure it



## 5. (Cont.)

If A., B., or C.:

E. How do you measure (or would like to) programmer productivity and what specific units are measured?

	<u>Comment</u>	<u>Specific Unit of Measurement</u>
Cost Related		
Time Related	* Most commonly: keep track of the complexity of the task and the time involved to complete it	
Quality Related	Once tried to measure bugs/minute } not a good way to go!	
6. Productivity Aids:	* Can get an idea of which programmers are most efficient relative to each other	

A. What level of productivity improvement would persuade you to adopt a new language for development purposes?

- Less than 5% ☐
- 5-14% ☐
- 15-24% ☐
- 25-49% ☒
- 50-99% ☐
- 100% or more ☐

We chose "C" over Pascal, even though we anticipated reduced productivity, because Pascal couldn't do what we needed.

7. A. Have you or do you intend to use languages specifically for program development?

☒ Yes, ☐ No, Why Not? Briefly tried Modula 2

B. What language(s) do you use? (we basically use C now)

C. What productivity improvement have you achieved?

- Less than 5% ☐
- 5-14% ☐
- 15-24% ☐
- 25-49% ☐
- 50-99% ☐
- 100% or more ☐

No answer.  
not sufficient experience



8. A. Do you use a machine (computer or workstation) for program development, that is different from the target machine?

☐ No ☒ Yes

- B. What type of machine(s)?

IBM PC for VM work; DEC PDP/11s - UNIX

- C. What productivity improvement have you achieved?

Less than 5% ☐

5-14% ☐

15-24% ☐

25-49% ☒

50-99% ☐

100% or more ☐

- D. Are these machines connected in any way? ☐ No ☒ Yes How?

Link to mainframe

9. What level of productivity improvements would persuade you to use a separate microcomputer-based workstation for program development?

Less than 5% ☐

5-14% ☐

15-24% ☐

25-49% ☐

50-99% ☐

100% or more ☐

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System (e.g., Unix) want an environment that is at least as generous as UNIX

Local Area Network Connection (LAN) \_\_\_\_\_

Specific LAN protocol (e.g., Ethernet) \_\_\_\_\_

Other Want code produced to be transferable to a wide range of environments

11. How would you rate the following languages by the two parameters of ease of learning (for professional programmers) - Ease of producing quality software.  
(Use Scale 1-10 where 10 = very easy, 1 = very hard)

	<u>Relative Ease of Learning</u>		<u>Relative Ease of Producing Quality Software</u>	
Cobol	<u>6</u>	4	<u>8</u>	2
Basic	<u>1</u>	9	<u>10</u>	1
Fortran	<u>4</u>	6	<u>8</u>	2
Pascal	<u>3</u>	7	<u>4</u>	6
ADA	<u>8</u>	2	<u>N/A</u>	
C	<u>4</u>	6	<u>6</u>	4
Coral	<u>4</u>	6	<u>5</u>	5
Algol	<u>4</u>	6	<u>5</u>	5
Modula 2	<u>4</u>	6	<u>3</u>	7
Other Languages				
• LISP	<u>HARD</u>		<u>EASY</u>	
• SMALLTALK	<u>3</u>	7	<u>3</u>	7

(Note: Do not need to answer for all languages. Qualify software would imply - efficient code, easy to amend and update, easily documented).

12. A. How much have you spent in the last year on specifically increasing programmer productivity?

\$50-75,000

- B. What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

	<u>Proportion</u>
Less than 5% <input type="checkbox"/>	_____
5-14% <input type="checkbox"/>	_____
15-24% <input type="checkbox"/>	_____
25-49% <input type="checkbox"/>	_____
50-99% <input type="checkbox"/>	_____
100% or more <input type="checkbox"/>	_____

*Actually invalid as a budget item  
It would be a capital expenditure*

*(\$50-100K as one time outlay)*

Ed Earle  
 Manager of Marketing and Technical Research (Vendor)

TYPE OF SOFTWARE DEVELOPMENT

1. Class of Business

A. Excluding in-house data processing, what type of product software development does your organization undertake?

Software development Tools

B. OEM? If OEM, please also answer question 2.

Market Segment	Percent of Business	Hardware	Operating Systems	Language	Application
<u>Cross-industry</u>	<u>100 %</u>	<u>Convergent Technology</u> <u>IWS</u>	<u>CTOS</u>	<u>Pascal</u> <u>Assemblee</u>	<u>Software dev tools</u>
_____	_____ %	_____	_____	_____	_____
_____	_____ %	_____	_____	_____	_____
_____	_____ %	_____	_____	_____	_____
_____	_____ %	_____	_____	_____	_____
Total	<u>100 %</u>				

What percent of your overall revenues does this business represent?

100 %

C. Embedded Systems?

Application Type/Product	Percent of Business	Hardware	Operating Systems	Language
_____	_____ %	_____	_____	_____
_____	_____ %	_____	_____	_____
_____	_____ %	_____	_____	_____
_____	_____ %	_____	_____	_____
_____	_____ %	_____	_____	_____

What percent of your overall revenue does this business represent?

\_\_\_\_\_ %

D. Product Software?

<u>Hardware</u>	<u>Operating Systems</u>	<u>Language</u>	<u>Application</u>	<u>Percent of Business</u>
Microprocessor				%
Mini Mainframe				%
Other (specify)				%
				%
Total				100 %

What percent of your overall revenue does this business represent?  
%

2. If OEM only:

A. Do you make engineering changes to product? No

B. Do you attach your own or other manufacturers equipment to your systems?  
Yes. Printer (Florida Data)

C. Are you looking for new OEM opportunities either in terms of markets or products?  
Yes

Please give indication of what these are:

Markets: No

Products: ① Always evaluating new hardware price/performance.

② Tool development product areas as a whole



D. Do you have any specific criteria for new OEM products?

Operating System (E.G. Unix)

Window Software

Languages (E.G. Fortran 77, Pascal)

LAN Protocols (E.G. ethernet)

Response Time

Graphics (E.G. Resolution, Colors)

Mouse

Printing (E.g. Laser)

Memory Size

Disk Storage

Application Development (e.g. speed of)

Price

Other

E. What do you find most restricting about the equipment you are currently marketing as an OEM?

3. A. How many software development programmers do you employ?

Total 80 employees

B. How many development M/C's do you have?

C. What is the approximate total dollars spent on software development per annum?

\$

Not available

now:

MS/DOS CPM/86

eventually want to

get away from operating systems

"probably"

altogether.

we don't need windows, people are getting heated on them

anyway

Pascal, its module 2

interested in that, will become involved: CTN convergent technology.

"it has to be good"!

Yes - color/graphics becoming industry standards

Yes

Want laser for quality and dot matrix (at reduced cost)

1/2 mg - 1 mg

20 - 30 mb

That is our product

micro computer product oriented

Have to be careful about hardware due to

continual changes in technology. Perhaps have software be less hardware dependent

Converg. Tech.

Too much capability available on IWS System

Products developed on these machines are not readily adaptable to less powerful machines of other vendors

(est) 25

10

## 3. (Cont.)

D. Do you sub-contract software development work to third parties?

no

E. If so, what proportion of the above is subcontracted?

## 4. Software Development Productivity

*Responding as a vendor her*

A. How would you rate the following major elements of software development in terms of their importance to your organization?

	Very Important	Important	Neutral	Not Important
Specification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Programming	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Construction	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verification	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

B. What percent of the overall development is represented by programming, including compilation and testing of individual modules?

Typically programming is 40-60%, should be 20%.

Our products try to overcome this

5. Which of the following statements best fits your position with regard to programmer productivity?

- A. ☐ We measure programmer productivity
- B. ☐ We have attempted to do this
- C. ☐ We would like to
- D. ☒ We do not measure it

## 5. (Cont.)

If A., B., or C.:

E. How do you measure (or would like to) programmer productivity and what specific units are measured?

	<u>Comment</u>	<u>Specific Unit of Measurement</u>
Cost Related		
Time Related		
Quality Related		

## 6. Productivity Aids:

A. What level of productivity improvement would persuade you to adopt a new language for development purposes?

- Less than 5% ☐  
 5-14% ☐  
 15-24% ☐  
 25-49% ☐  
 50-99% ☐  
 100% or more ☐

Languages are not the  
 main concern with  
 improving productivity,  
 only impact programming portion.  
 You need to improve  
 specification, design phases

7. A. Have you or do you intend to use languages specifically for program development?

☒ Yes, ☐ No, Why Not?

(module 2 planned)

B. What language(s) do you use? 80/86, Pascal, Assembler

C. What productivity improvement have you achieved?

- Less than 5% ☐  
 5-14% ☐  
 15-24% ☐  
 25-49% ☐  
 50-99% ☐  
 100% or more ☐

no answer



8. A. Do you use a machine (computer or workstation) for program development, that is different from the target machine?

☒ No ☐ Yes

*Convergent Technology only*

- B. What type of machine(s)?

- C. What productivity improvement have you achieved?

Less than 5% ☐

5-14% ☐

15-24% ☐

25-49% ☐

50-99% ☐

100% or more ☐

*no answer*

- D. Are these machines connected in any way? ☒ No ☐ Yes How?

*Ability to cluster Convergent Technology machines*

9. What level of productivity improvements would persuade you to use a separate microcomputer-based workstation for program development?

Less than 5% ☐

5-14% ☐

15-24% ☐

25-49% ☐

50-99% ☐

100% or more ☐

*not applicable*

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System (e.g., Unix)

Local Area Network Connection (LAN)

Specific LAN protocol (e.g., Ethernet)

Other

*not applicable*



11. How would you rate the following languages by the two parameters of ease of learning (for professional programmers) - Ease of producing quality software.  
(Use Scale 1-10 where 10= very easy, 1 = very hard)

	<u>Relative Ease of Learning</u>		<u>Relative Ease of Producing Quality Software</u>	
Cobol	<u>5</u>	5	<u>10</u>	1
Basic	<u>2</u>	8	<u>3</u>	7
Fortran	<u>4</u>	6	<u>7</u>	3
Pascal	<u>5</u>	5	<u>5</u>	5
ADA	<u>N/A</u>		<u>N/A</u>	
C	<u>6</u>	4	<u>6</u>	4
Coral	<u>N/A</u>		<u>N/A</u>	
Algol	<u>N/A</u>		<u>N/A</u>	
Modula 2	<u>3</u>	7	<u>1</u>	10
Other Languages	<u>          </u>		<u>          </u>	
<u>• APL / Fourth Generation are easier in general to learn</u>				

(Note: Do not need to answer for all languages. Qualify software would imply - efficient code, easy to amend and update, easily documented).

12. A. How much have you spent in the last year on specifically increasing programmer productivity?

General only - that is our product

- B. What proportion of you overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

	<u>Proportion</u>
Less than 5%	<input type="checkbox"/> <u>unknown</u>
5-14%	<input type="checkbox"/> <u>          </u>
15-24%	<input type="checkbox"/> <u>          </u>
25-49%	<input type="checkbox"/> <u>          </u>
50-99%	<input type="checkbox"/> <u>          </u>
100% or more	<input type="checkbox"/> <u>          </u>

Ron DeWitt Planning &amp; Research. (Vendor)

TYPE OF SOFTWARE DEVELOPMENT

## 1. Class of Business

- A. Excluding in-house data processing, what type of product software development does your organization undertake?

insurance, health, banking, government, commercial systems.

- B. OEM? If OEM, please also answer question 2.

Market Segment	Percent of Business	Hardware	Operating Systems	Language*	Application.
<u>Insurance</u>	<u>NA</u> %	<u>TI, DEC</u>			<u>INSURANCE</u>
<u>Government</u>	%				<u>Info systems,</u>
<u>Bank &amp; Thrift</u>	%	<u>IBM</u>			<u>financial syst.</u>
	%	<u>DEC, DG</u>			<u>Banking</u>
	%				<u>Legal, public</u>
	%				<u>distrib. acct. credit process</u>
Total	<u>100</u> %				

\* Most IBM mainframe is based on COBOL

What percent of your overall revenues does this business represent?

NA %

## C. Embedded Systems?

Application Type/Product	Percent of Business	Hardware	Operating Systems	Language
	%			
	%			
	%			
	%			
	%			

What percent of your overall revenue does this business represent?

 %

## D. Product Software?

<u>Hardware</u>	<u>Operating Systems</u>	<u>Language</u>	<u>Application</u>	<u>Percent of Business</u>
Microprocessor	_____	_____	_____	_____%
Mini Mainframe	_____	_____	_____	_____%
Other (specify)	_____	_____	_____	_____%
_____	_____	_____	_____	_____%
Total				<u>100 %</u>

What percent of your overall revenue does this business represent?

\_\_\_\_\_%

## 2. If OEM only:

A. Do you make engineering changes to product? not normally

B. Do you attach your own or other manufacturers equipment to your systems?

Yes

C. Are you looking for new OEM opportunities either in terms of markets or products?

Certainly

Please give indication of what these are:

Markets: \_\_\_\_\_

Products: Depends on our client requirements

- D. Do you have any specific criteria for new OEM products? - *Varies by product area*
- Operating System (EG Unix) \_\_\_\_\_
- Window Software \_\_\_\_\_
- Languages (E.G. Fortran 77, Pascal) Cobol now
- LAN Protocols (E.G. ethernet) \_\_\_\_\_
- Response Time \_\_\_\_\_
- Graphics (E.G. Resolution, Colors) \_\_\_\_\_
- Mouse \_\_\_\_\_
- Printing (E.g. Laser) \_\_\_\_\_
- Memory Size \_\_\_\_\_
- Disk Storage \_\_\_\_\_
- Application Development (e.g..speed of) \_\_\_\_\_
- Price \_\_\_\_\_
- Other \_\_\_\_\_
- would have to talk to individual dept. areas*

- E. What do you find most restricting about the equipment you are currently marketing as an OEM?

*no answer*

3. A. How many software development programmers do you employ? *about* 2,000-3,000
- B. How many development M/C's do you have? 9-IBM 4300's
- C. What is the approximate total dollars spent on software development per annum?
- \$ NO ANSWER



3. (Cont.)

D. Do you sub-contract software development work to third parties?

Small %

E. If so, what proportion of the above is subcontracted? . ?

4. Software Development Productivity

A. How would you rate the following major elements of software development in terms of their importance to your organization?

*Ongoing debate in the industry*

	Very Important	Important	Neutral	Not Important
Specification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Programming	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Construction	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

B. What percent of the overall development is represented by programming, including compilation and testing of individual modules?

50%

5. Which of the following statements best fits your position with regard to programmer productivity?

A. ☐ We measure programmer productivity

B. ☒ We have attempted to do this

C. ☐ We would like to

D. ☐ We do not measure it

## 5. (Cont.)

If A., B., or C.:

E. How do you measure (or would like to) programmer productivity and what specific units are measured?

	<u>Comment</u>	<u>Specific Unit of Measurement</u>
Cost Related	In the process of developing function point measurement method dev. by IBM.	
Time Related		
Quality Related		

## 6. Productivity Aids:

A. What level of productivity improvement would persuade you to adopt a new language for development purposes?

- Less than 5% ☐  
 5-14% ☐  
 15-24% ☐  
 25-49% ☐  
 50-99% ☐  
 100% or more ☐

at least 700% - 1000%

7. A. Have you or do you intend to use languages specifically for program development?

☐ Yes, ☒ No, Why Not? COBOL generally accepted as a language by the business industry.

B. What language(s) do you use? COBOL

C. What productivity improvement have you achieved?

- Less than 5% ☐  
 5-14% ☐  
 15-24% ☐  
 25-49% ☐  
 50-99% ☐  
 100% or more ☐

NA

Looking more at application generators as a tool that would benefit us.

8. A. Do you use a machine (computer or workstation) for program development, that is different from the target machine?

☒ No ☐ Yes

B. What type of machine(s)? NA

C. What productivity improvement have you achieved?

- Less than 5% ☐
- 5-14% ☐
- 15-24% ☐
- 25-49% ☐
- 50-99% ☐
- 100% or more ☐

NA

D. Are these machines connected in any way? ☐ No ☐ Yes How? NA

9. What level of productivity improvements would persuade you to use a separate microcomputer-based workstation for program development?

- Less than 5% ☐
- 5-14% ☐
- 15-24% ☐
- 25-49% ☐
- 50-99% ☐
- 100% or more ☒

would have to be high.  
IBM PC a consideration

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System (e.g, Unix) IBM compatible  
Local Area Network Connection (LAN) yes definitely - uncertain  
Specific LAN protocol (e.g, Ethernet) which we we go with  
Other \_\_\_\_\_



11. How would you rate the following languages by the two parameters of ease of learning (for professional programmers) - Ease of producing quality software.

(Use Scale 1-10 where 10 = very easy, 10 = very hard)

	Relative Ease of Learning	Relative Ease of Producing Quality Software	
Cobol	<u>3</u> 7	<u>5</u> 5	Gives you more flexibility will handle complex file structures.
Basic	<u>3</u> 7	<u>8</u> 2	
Fortran	<u>5</u> 5	<u>5</u> 5	
Pascal	<u>-</u>	<u>-</u>	
ADA	<u>-</u>	<u>-</u>	Language has really not that much to do with increased productivity.
C	<u>-</u>	<u>-</u>	
Coral	<u>-</u>	<u>-</u>	
Algol	<u>-</u>	<u>-</u>	
Modula 2	<u>-</u>	<u>-</u>	
Other Languages	<u>-</u>	<u>-</u>	Fourth generation languages best for low volume inquiry - not for our applications
	<u>-</u>	<u>-</u>	

(Note: Do not need to answer for all languages. Qualify software would imply - efficient code, easy to amend and update, easily documented).

12. A. How much have you spent in the last year on specifically increasing programmer productivity?

Effort more centralized now, more research now.

- B. What proportion of you overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

	Proportion
Less than 5%	<input type="checkbox"/> _____
5-14%	<input type="checkbox"/> _____
15-24%	<input type="checkbox"/> _____
25-49%	<input type="checkbox"/> _____
50-99%	<input type="checkbox"/> _____
100% or more	<input type="checkbox"/> _____

Not a decision easily made.  
Would have to save more than it cost  
Speed of pay back



PO Drawer 280237 DALLAS TX, 75228

## MARKET POTENTIAL

Jon Capps President (Vendor)

TYPE OF SOFTWARE DEVELOPMENT

## 1. Class of Business

- A. Excluding in-house data processing, what type of product software development does your organization undertake?

Process control, DSS, quality assurance, data tracking, budgets.

- B. OEM? If OEM, please also answer question 2.

Market Segment	Percent of Business	Hardware	Operating Systems	Language	Application
<u>Water &amp; waste</u>	<u>40 %</u>	<u>microprocessor</u> <u>6502</u> <u>8880</u>	<u>proprietary</u> <u>SMOS</u>	<u>Assembler</u>	<u>Process control</u>
<u>&amp; manuf. (heavy)</u>	<u>60 %</u>	<u>IBM PC</u>	<u>PC DOS</u>	<u>APL</u>	<u>Decision support /</u>
<u>Cross industry</u>	<u>%</u>	<u></u>	<u></u>	<u></u>	<u>business applications</u>
<u></u>	<u>%</u>	<u></u>	<u></u>	<u></u>	<u></u>
<u></u>	<u>%</u>	<u></u>	<u></u>	<u></u>	<u></u>
Total	<u>100 %</u>	<u>*Small business market</u> <u>\$100-200K /yr comp</u>			

What percent of your overall revenues does this business represent?

100 %(Although Fruto-Lay is now a client)

## C. Embedded Systems?

Application Type/Product	Percent of Business	Hardware	Operating Systems	Language
<u></u>	<u>%</u>	<u></u>	<u></u>	<u></u>
<u></u>	<u>%</u>	<u></u>	<u></u>	<u></u>
<u></u>	<u>%</u>	<u></u>	<u></u>	<u></u>
<u></u>	<u>%</u>	<u></u>	<u></u>	<u></u>
<u></u>	<u>%</u>	<u></u>	<u></u>	<u></u>

What percent of your overall revenue does this business represent?

%

D. Product Software?

no*(Once run-time APL system comes out I will consider)*

<u>Hardware</u>	<u>Operating Systems</u>	<u>Language</u>	<u>Application</u>	<u>Percent of Business</u>
Microprocessor				%
Mini Mainframe				%
Other (specify)				%
				%
Total				<u>100 %</u>

What percent of your overall revenue does this business represent?

       %

2. If OEM only:

A. Do you make engineering changes to product?

Yes - modifyHP plotters

B. Do you attach your own or other manufacturers equipment to your systems?

HP plotter, IDS drum printer, Epson Printer

C. Are you looking for new OEM opportunities either in terms of markets or products?

Always looking. Deciding our direction now.

Please give indication of what these are:

Markets:

More cross industry business applications,

Products:

Small company decision support

"IBM will have 85% of market by 1985"

D. Do you have any specific criteria for new OEM products?

Operating System (EG Unix) Pushing IBM equip - push IBM compatibility <sup>IBM PC-DOS, MS-D</sup>

Window Software NO

Languages (E.G. Fortran 77, Pascal) Like APL best\* - programming speed good

LAN Protocols (E.G. ethernet) PCnet on cost basis is effective

Response Time no problems, not a concern for us.

Graphics (E.G. Resolution, Colors) Everybody wants it. For us IBM straight graphics is ok

Mouse Should be terminated - little use for it. Like HP touch screen best.

Printing (E.g. Laser) Laser too expensive for our clients, we sell dot matrix or daisy wheel. Speed important

Memory Size 256K usually. Memory not a problem.

Disk Storage 360K, 5 1/2" floppy. mainly

Application Development (e.g. speed of) all vendor done

Price suggested retail on \$ 3,000 (software only) average hardware.

Other \_\_\_\_\_

E. What do you find most restricting about the equipment you are currently marketing as an OEM?

Hardware vendors want us to buy so many units per year. Would rather purchase as we need. Would like to see vendor support independent consultants like me.

3. A. How many software development programmers do you employ? 11-15 average per job.

B. How many development M/C's do you have? 2 { 1-IBM PC 1-Diser Modula

C. What is the approximate total dollars spent on software development per annum? RE: DISER: DUMB MACHINE for \$17K. Great graphics. One language only. Documentation poor

\$ NOT AVAIL

\* "Can write in a week with APL. what it takes a year to do in BASIC." no support. Too restricting. Huge price of input



3. (Cont.)

D. Do you sub-contract software development work to third parties?

always

E. If so, what proportion of the above is subcontracted? 100%

4. Software Development Productivity

A. How would you rate the following major elements of software development in terms of their importance to your organization?

		Very Important	Important	Neutral	Not Important
10%	Specification	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20%	Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5%	Programming	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Construction	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
25%	Documentation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40%	Verification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Operation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

~ not my problem - user handles.

B. What percent of the overall development is represented by programming, including compilation and testing of individual modules?

5%

5. Which of the following statements best fits your position with regard to programmer productivity?

- A. ☐ We measure programmer productivity
- B. ☐ We have attempted to do this
- C. ☐ We would like to
- D. ☒ We do not measure it



## 5. (Cont.)

If A., B., or C.:

E. How do you measure (or would like to) programmer productivity and what specific units are measured?

*No point in measuring. I consider a programmer an artist. I give him specs and whenever he feels he can finish it is*

	<u>Comment</u>	<u>Specific Unit of Measurement</u>
Cost Related		<i>when it should get done. We are</i>
Time Related		<i>under contract and I expect the work to be</i>
Quality Related		<i>completed when the programmer says it will.</i>

## 6. Productivity Aids:

A. What level of productivity improvement would persuade you to adopt a new language for development purposes?

- Less than 5% ☐
- 5-14% ☐
- 15-24% ☐
- 25-49% ☐
- 50-99% ☐
- 100% or more ☐

*Wouldn't.*

*I don't think you can!*

*Cannot beat APL -*

*an interpretive language*

*SPSC version is*

*excellent.*

7. A. Have you or do you intend to use languages specifically for program development?

☐ Yes, ☒ No, Why Not? *Very disappointed with Diser product. non transportable.*

B. What language(s) do you use?

C. What productivity improvement have you achieved? *Diser:*

- Less than 5% ☒
- 5-14% ☐
- 15-24% ☐
- 25-49% ☐
- 50-99% ☐
- 100% or more ☐

*none*

*I dislike Pascal*

*language anyway*

*Cannot communicate*

*with other machines.*

*Cannot program in*

*other languages.*

8. A. Do you use a machine (computer or workstation) for program development, that is different from the target machine?

☒

No

☐

Yes

*Not now*

B. What type of machine(s)? (Irid Dsair)

C. What productivity improvement have you achieved? *Dsair*

Less than 5% ☒

5-14% ☐

15-24% ☐

25-49% ☐

50-99% ☐

100% or more ☐

*none*

D. Are these machines connected in any way? ☒ No ☐ Yes How?

9. What level of productivity improvements would persuade you to use a separate microcomputer-based workstation for program development?

Less than 5% ☐

5-14% ☐

15-24% ☐

25-49% ☐

50-99% ☐

100% or more ☐

*These questions really don't apply since I prefer hiring outside staff. Have been very successful in getting the job done.*

10. Would you have any specific requirements in connection with the introduction of a new development environment?

Operating System (e.g., Unix) \_\_\_\_\_

Local Area Network Connection (LAN) \_\_\_\_\_

Specific LAN protocol (e.g., Ethernet) \_\_\_\_\_

Other \_\_\_\_\_

11. How would you rate the following languages by the two parameters of ease of learning (for professional programmers) - Ease of producing quality software.

(Use Scale 1-10 where 10 = very easy, 1 = very hard)

*For use on micro only %*

*COBOL is a mainframe language*

	Relative Ease of Learning		Relative Ease of Producing Quality Software	
Cobol	<u>2</u>	8	<u>6</u>	4
Basic	<u>3</u>	7	<u>8</u>	2
Fortran	<u>8</u>	2	<u>9</u>	1
Pascal	<u>4</u>	6	<u>4</u>	6
ADA	<u>-</u>		<u>-</u>	
C	<u>7</u>	3	<u>5</u>	5
Coral	<u>-</u>		<u>-</u>	
Algol	<u>-</u>		<u>-</u>	
Modula 2	<u>4</u>	6	<u>3</u>	7
Other Languages APL	<u>7</u>	3	<u>3</u>	7

(Note: Do not need to answer for all languages. Qualify software would imply - efficient code, easy to amend and update, easily documented).

12. A. How much have you spent in the last year on specifically increasing programmer productivity?

nothing - *Programmers all subcontracted they necessarily meet schedules*

- B. What proportion of you overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

	Proportion	
Less than 5%	<input type="checkbox"/>	<u>                    </u>
5-14%	<input type="checkbox"/>	<u>none</u>
15-24%	<input type="checkbox"/>	<u>                    </u>
25-49%	<input type="checkbox"/>	<u>                    </u>
50-99%	<input type="checkbox"/>	<u>                    </u>
100% or more	<input type="checkbox"/>	<u>                    </u>

*Spend our money on familiarizing our people with new hardware technology.*





APPENDIX D.



## APPENDIX D : COMPLETED QUESTIONNAIRES : USER





INPUT QUESTIONNAIRE

CATALOG NO. YDIS

STUDY TITLE : DISER/GENEVEST

TYPE OF QUESTIONNAIRE : USER

CERN

Dottore Palazzi - Processing of experimental  
data, some training

Doktor Petrus Van der Stok

- process control  
software -

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

# Organisation Européenne pour la Recherche Nucléaire

30.1.84.

- 1 - (European Nuclear Research Institute)

## TYPE OF S/W DEVELOPMENT

### 1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

#### a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application
	Not applicable This is NOT a commercial but research organisation.				

#### b) Embedded systems? ✓

Application Type/Product	% of Business	H/W	O/S	Language
Real time process control applications		DISCR	Modula 2	

In the future  
Modula 2  
will be used on  
any workstation  
using UNIX  
operating system.

(also use Norsk Data  
IBM, Siemens, Dec)

#### c) Product Software? ✓

H/W	O/S	Language	Application	% of Business
Microprocessor ✓		Modula 2	Control software	100%
Mini ✓	VMS / Unix Vx		Utilities	
Mainframe ✓	MVS-IBM			
Other - please specify	Norsk Data			

Pak22 — we are looking for a workstation where  
WE are the software developers  
— laboratory control — workstation \*

2. FOR OEM BUSINESS ONLY:

a) Do you make or intend to make engineering changes to the DISER product?

---

b) Do you attach your own or other manufacturers equipment to your systems?

---

c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:

Markets: 

---

Products: 

---

d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX)  
Window Systems/Operating Environments  
Languages (eg FORTRAN 77, PASCAL)  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price  
Anything else

*Not applicable*

e) What do you find most restricting about the DISER equipment you are marketing as an OEM?

---

---

---

3.

a) How many software development programmers do you employ?

In Van der Stok's organisation - 5/6 accelerator control programmers -

b) How many development m/c's do you have?

In process control 6

(of which 2 = DISER)

(c 200 in total in CER)  
who write software which corresponds to how one machine programs

c) What is the approximate total spent on software development per annum?

Not available

d) Do you subcontract software development work to third parties?

YES

Dev. - c. 40%

Proc. Control < 2.0%

e) If so, what proportion of the above is subcontracted?

Approximately 30% of current project based on DISER eqpt

f) What proportion of development is currently based on DISER equipment?



Powerful workstation devices would be of great interest to us - currently using

2 Pary

3 Apollo

1 HP 9000 on loan

2 Disos

DISER: Useful for  
For program development: data analysis, process control, but also could be used for document preparation, text editing, processing P.T.O. →



We have ~~finished~~ development on our  
Pera machines — (which were previously  
redundant) — project on to develop  
Exhibition/animation software to show  
visitors round CERN.

No guidelines yet established regarding  
procurement for personal workstations so  
much on the market — need to wait until the  
market stabilises —

---

VanderStok

— Unix, Pascal, Modula 2 compilers

— IL process control & microprocessor  
— networking to central computer  
facility.

— here we value availability of good  
FORTRAN Computers

Application people — only system they seem to like  
is Apollo — good Fortran compiler & debugger  
(evaluation of experimental data & writing of  
correspondent ~~slw~~).

(can't use Drex since NO Fortran so far)

Some projects starting now are beginning to look at these factors

SOFTWARE DEVELOPMENT PRODUCTIVITY <sup>- 4 -</sup> (everything dictated by hardware)

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification	✓ (but rated LOW if CERN if general)			
Design	depends on how many people involved in a project.			
Programming	we are obliged to program anyway			
Construction	how to do S/W engineering			
	- so far too much emphasis on CODING &			
Documentation	NOT enough on DESIGN			
Verification				
Operation				

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

c. 30% (IL PROCESS Control)

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☐
- c) We would like to ☐
- d) We do not measure it ☒

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

Comment	Specific unit of measurement
Cost Related	only really IL budgeting of a software project & NOT IL programmer productivity
Time Related	
Quality Related	

only some cost modelling NO general policy this'd

CERN overall

- only happened to one project they  
member - covering a 100 man hour  
project - a medium sized project -

Specifications can change all the time.

Nucleus of the spec. is laid down  
but peripheral activity can also change.

Our lab. here - no Bible of software  
engineering as is the Space Agency.  
Attempts made in uncoordinated  
fashion.

Measurement of productivity  
totally unmaterial



PRODUCTIVITY AIDS

6. a) What level of productivity improvement have you achieved through using MODULA 2 as a new language for development purposes?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( ) Inhibitive  
( )  
( )  
( ) c 500% increase  
( ) Using Assembler

- b) How would you rate the quality of programs produced by MODULA 2?

Benefits don't come for the specification phase but because we are obliged to think more

7. What level of productivity improvement have you achieved from using separate DISER machines for program development?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( )  
( )  
( )  
( )  
( )  
( )  
before coupling  
transition of a modula 2  
compiler

8. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) - ease of producing quality s/w.  
Use a scale of 10 very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA 2	These questions make no sense for us.	
COBOL		
BASIC		(not comparable)
FORTRAN		
PASCAL		
ADA		
C		
CORAL ALGOL Other Languages		

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).



Always used Fatran up to now

- how exploratory Module 2  
for new projects -

In our field (data reduction, evaluation  
non experiments), we are now looking at  
what it means to use another  
language.

Choice of language instead of Assembler  
- 6 -  
= to improve productivity

9. a) How much have you spent in the last year on specifically increasing programmer productivity?

Can only be gauged in a qualitative sense

- b) What proportion of this was for DISER products? - not in this project -  
Not involved in process control

- c) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%

5-14%

15-25%

25-49%

50-99%

100% or more

( ) Have been given a budget for  
( ) writing software -  
( ) any assessment is an PIF!

10. a) What do you consider to be the most valuable features of the DISER system as far as your company is concerned?

(In order of priority) 1. single user workstation  
2. capability to transfer files to centre as a  
3. side queue  
4. with Mod 2 - spw-des.

- b) What do you consider to be the greatest deficiencies of the DISER system at the moment as far as your company is concerned?

(In order of priority) 1. in our case: -  
2. work on naked microprocessor - compiler code  
3. structure was far too much  
4. hidden from the user.

Not a controlled environment here

- many national / political - requirements & constraints

Palazzi - requirements standard of sys + networking -  
Good language support for Fortran

Palazzi — using DISE machine  
for educational purposes —

to learn Module 2  
(Structural programming) in particular  
for REAL time applications —

For data Evaluation — used FORTRAN

RESPONDENT

Dr : Paolo Pazzi

TITLE

: Dr Petrus van der Stok

COMPANY

:

ADDRESS

: Centre Européen de  
Recherche Nucléaire

1211 Geneva 23 Switzerland

TOTAL REVENUE OF COMPANY

: L/A

TOTAL NUMBER OF COMPANY EMPLOYEES

: c. 100 s/wale

Engineers/prog

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE



INPUT QUESTIONNAIRE

CATALOG NO. YDIS

STUDY TITLE : DISER/GENEVEST

TYPE OF QUESTIONNAIRE : USER

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

As <sup>CNAME</sup> Educational Tool

Palazzi — Dser<sup>1</sup> is a training  
TYPE OF S/W DEVELOPMENT  
 machine

1. class of Business

### 1. Class of Business

Excluding in-house data processing what type of product/software development does your organisation undertake?

a) OEM?

- der. d. propädeut. (10 hr. Session)

Market Segment	% of Business	H/W	O/S	Language	Application
<p>V. positive response from students</p> <p>- Disgr. eqpt. to learn module</p>					

2 was a very adequate machine.

**b) Embedded systems?**

Application Type/Product	% of Business	H/W	O/S	Language
	Control Sys. for new accelerators			
	All prog. to be done in Mod 2 -			
	to be completed by 10/1/78			

Target machine 68000 Microprocessor -

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor	VMS	MODULA I. II for language	SYSTEMS ARCHITECTURE	EDUCATIONAL INSTITUTE —
Mini	UNIX		— USING THE SAME	NO
Mainframe	DEC		LANGUAGE FOR	COMMERCIAL
Other — please specify	APL II		SOLVING VARIOUS PROBLEMS	APPLICATIONS, Extended

- machine is expensive.

On our central computer, we have a cross compiler  
for M202 — this C-compiler is an upgrade from Zurd.c.  
C — produces code for several microprocessors (Motorola 68000  
+ Texas Instruments) — download —

2. FOR OEM BUSINESS ONLY:

- a) Do you make engineering changes to the products you buy in?

\_\_\_\_\_

- b) Do you attach your own or other manufacturers equipment to your systems?

\_\_\_\_\_

- c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:

Markets: \_\_\_\_\_

Products: \_\_\_\_\_

- d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX)  
Window Systems/Operating Environments  
Languages (eg FORTRAN 77, PASCAL)  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price  
Anything else

- e) What do you find most restricting about the equipment you are currently marketing as an OEM?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Re students qualifications - they must have  
d.p. diploma in order to register for CNAM courses.

- 3 -

3.

a) How many software development programmers do you employ?

NO PROGRAMMERS AS SUCH.

10 STUDENTS ATTEND EVENING "OPEN UNIVERSITY" CLASSES.

4-5 STUDENTS ATTEND DAYTIME COURSE.

b) How many development m/c's do you have?

3 X VAX

3 X PDP 11

Do not run Modula on PDP 11s.

with

40 workstations

with

4 workstations each ie 12

c) What is the approximate total spent on software development per annum?

N/A

d) Do you subcontract software development work to third parties?

N/A

e) If so, what proportion of the above is subcontracted?

N/A



Re Q.4. Respondent notes that the elements ~~are~~ vary greatly in their importance for each project.  
 Stresses that RELIABILITY, MAINTAINABILITY AND OVERALL PRODUCTIVITY are more relevant for development evaluations.

SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification				
Design	USE IBM META IV			
Programming				
Construction	Need common language for programming.			
Documentation				
Verification				
Operation				

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

N/A - not a production situation

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☐
- c) We would like to ☐
- d) We do not measure it ☒

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related		
Quality Related		

PRODUCTIVITY AIDS

6. a) What level of productivity improvement have you achieved through using MODULA 2 as a new language for development purposes?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( ) Cannot quantify due to variations in activities.  
( ) However for CRM purposes Mod...  
( ) much more productive than other languages.  
( ) Advantages include ① SEPARATE COMPILATION  
( ) ② DIRECT ARCHIVE ACCESS.  
( ) ③ OPTIMUM USE OF RESOURCES.

- b) How would you rate the quality of programs produced by MODULA 2?  
Have to relate to the generation of software currently available. The language change is justified by the opportunity of using a different approach to a prob...

7. What level of productivity improvement have you achieved from using separate DISER machines for program development?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

( ) N/A. Only use separate PDP11 for program development.  
( ) Cannot quantify DISER productivity.  
( ) feels that PORTABILITY of SW in been substantially improved.

8. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) - ease of producing quality s/w.

Use a scale of 10 very easy to 1 very hard  
Depends on experience of user & program.

Depends on complexity of project & professional calibre of programmer.

Gets easier to learn new languages when have already mastered a language.	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA 2	more complex than Pascal	
COBOL		
BASIC	(10)	Can have very large problems.
FORTRAN	(9)	
PASCAL		
ADA	very rich system. more difficult than modula.	
C		
CORAL ALGOL Other Languages		

✓ Module 2  
(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

9. a) How much have you spent in the last year on specifically increasing programmer productivity?

N/A no info available

- b) What proportion of this was for DISER products?

N/A. no info available

- c) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

N/A.

10. a) What do you consider to be the most valuable features of the DISER system as far as your company is concerned?

- (In order of priority)
1. VDU very good.
  2. MULTI-WINDOWS very good.
  3. COMPILATION VERY FAST COMPARED WITH PDP 11.
  4. \_\_\_\_\_
- } Emphasises the man/machine interface - very satisfactory

- b) What do you consider to be the greatest deficiencies of the DISER system at the moment as far as your company is concerned?

1. Need more memory to make full use of windows.
2. Cost of disk interruptions <sup>eg 2 megs.</sup> - processes ind'l
3. Need disk to be a disk interface.
4. \_\_\_\_\_



RESPONDENT

: MR. JEWEZ

TITLE

: MAÎTRE ASSISTANT.

COMPANY

: ARTS ET MÉTIERS.

ADDRESS

: 2, RUE CONTÉ  
PARIS 3.

TOTAL REVENUE OF COMPANY

: —

TOTAL NUMBER OF COMPANY EMPLOYEES

: —

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE



## NOTES on CWAM.

①

Discussions between Mr Dewez + Waldberger focussed on aspects of Burologie + documentation eg. document entry, optical character reading (OCR) (with application for braille for this Mr Dewez is working on a prototype).

Other interest is simulation of DDP.

### Evaluation of Modula

Generally the weakness of available spw is its unsuitability for 'natural' activities in that they tend to be very structured.

Modula is superior in that it facilitates a more abstract approach to problems. This feature will make it very appropriate for the more advanced leading edge user who follows the trend in artificial intelligence expert systems (which check the logic of the users assumptions).

### Re productivity

The technique of productivity is very important & is currently being studied by many universities.

### Development of Modula 2

Because Modula 2 separates the source of 'design/conception' from the other analysts etc using the system there is a need for a ~~more~~ language which describes <sup>updates</sup> the specification of projects.

INPUT QUESTIONNAIRE

CATALOG NO. YDIS

STUDY TITLE : DISER/GENEVEST

TYPE OF QUESTIONNAIRE : USER

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

TYPE OF S/W DEVELOPMENT1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM? *IN FUTURE. POSSIBLE BUT NOT INTERESTED RSP.*

Market Segment	% of Business	H/W	O/S	Language	Application
					/

b) Embedded systems? *No.*

Application Type/Product	% of Business	H/W	O/S	Language

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor	CPM (other department)	ASSEMBLER PASCAL	RECOGNITION. VOICESYNTHESIS LOCAL COMMS INTERFACES	ONLY FOR INHOUSE.
Mini	① DATA GENERAL ECLIPSE O/S	FORTRAN + ASSEMBLER	SCREEN PROCESSORS,	
Mainframe	② CITIB MITRA.	A.T.R	① RADAR & traffic control.	100%.
	③ PHILIPS.	RTLII	② RADAR WITH Backup.	clients' software.
	④ GOULD 3277	FORTRAN.	③ Radar Data Processing	
Other - please specify			④ Inhouse - Real-time air traffic control	

*Simulation. (THROUGH LINK WITH GOULD mini)*

Mainframe  
 IBM 4341  
 Siemens 7800  
 VMCMS.  
 (IBM) MVS.  
 PLI  
 FORTRAN

PREPARATION &  
ANALYSIS OF  
SIMULATION.  
GENERAL PURPOSE  
S/W EXCEPT  
ADMIN + GRAPHICS  
PROJECT CONTROL.  
FAST TIME SIMULATOR

*raise only 10% of co. activ.*

2. FOR OEM BUSINESS ONLY:

a) Do you make or intend to make engineering changes to the DISER product?

---

b) Do you attach your own or other manufacturers equipment to your systems?

---

c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:

Markets: 

---

Products: 

---

d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX)  
Window Systems/Operating Environments  
Languages (eg FORTRAN 77, PASCAL)  
LAN protocols (eg ETHERNET)  
Response time  
Graphics (eg Resolution, Colour)  
Mouse  
Printing  
Memory Size  
Disk Storage  
Software Development (eg Speed of)  
Price  
Anything else

e) What do you find most restricting about the DISER equipment you are marketing as an OEM?

---

---

---



Sm gp - project leader =  
chief programmer or  
system designer

- 3 -

Large group - project leader  
coordinates.

3.

a) How many software development programmers do you employ?

Do not have coders.

50 - 80.

b) How many development m/c's do you have? *Siemens & Gould are major development machines. "Non permanent minis & client m/c"*  
40 workstations attached to mainframes.

4x Hewlett Packard 2 workstations on the Gould mini

c) What is the approximate total spent on software development per annum?

Inhouse : 60-70 man years per year. 31 million FF.  
clients :

d) Do you subcontract software development work to third parties?

Yes. but do not have a sub-contracting policy.

Buy packaged sw.

e) If so, what proportion of the above is subcontracted?

5-6 sw staff constantly under contract.

f) What proportion of development is currently based on DISER equipment?

Nothing yet.

Planned : Project for '85.

Destined for Eurocontrol School at Luxembourg to be implemented on PDP 11s.

Will initially use 1 <sup>Diser</sup> workstation for production for sw for PDP 11.

Diser purposes: ① to facilitate extra operating facilities for minis & mainframes  
②. Have a ~~network~~ Diser to simulate aspects of Air Traffic Control. Possibly prove to be a flexible tool.

Market evaluation prior to choice of Modula was focussed on Rank Xerox equip - too office oriented. Market potential Replacement of 200 mainframes for Fedra ATC - ccitt. Would not envisage rewriting all SW in Ada - too cumbersome. Possibly use Jovial - real time compiler.

SOFTWARE DEVELOPMENT PRODUCTIVITY

4. a) How would you rate the following major elements of software development in terms of their importance to your organisation?

	Very Important	Important	Neutral	Not Important
Specification				+
Design				+
Programming				+
Construction				+
Documentation				+
Verification + Quality Assurance	✓ for specification, documentation, methodology			
Operation				+

b) What % of the overall development is represented by programming, including compilation and testing of individual modules?

20%

5. Which of the following statements best fits your position with regard to programmer productivity?

- a) We measure programmer productivity ☐
- b) We have attempted to do this ☐
- c) We would like to ☐
- d) We do not measure it ☒

If a) or b) or c)

e) How do you measure (or would like to) programmer productivity and what specific units are measured?

	Comment	Specific unit of measurement
Cost Related		
Time Related		
Quality Related		

Maintainability i.e well documented & reliable.

PRODUCTIVITY AIDS

6. a) What level of productivity improvement have you achieved through using MODULA 2 as a new language for development purposes?

Less than 5%	( )	N/A.
5-14%	( )	
15-25%	( )	
25-49%	( )	
50-99%	( )	
100% or more	( )	

- b) How would you rate the quality of programs produced by MODULA 2?

*It's a suitable tool for an engineer in workstation for producer/user of ~~Modula~~ S/W. Depends on calibre of staff.*

7. What level of productivity improvement have you achieved from using separate DISER machines for program development?

Less than 5%	( )	N/A.
5-14%	( )	
15-25%	( )	
25-49%	( )	
50-99%	( )	
100% or more	( )	

8.

How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) - ease of producing quality s/w.

Use a scale of 10 very easy to 1 very hard

*Seems to be easy to make transition from Pascal to Modula*

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA 2	<i>Easy for standard tasks.</i>	<i>Have not used yet so cannot evaluate.</i>
COBOL		
BASIC		
FORTRAN		
PASCAL		
ADA		
C		
CORAL ALGOL Other Languages		

(Note: do not need to answer for all language.. Quality software would imply - efficient code, easy to amend and update, easily documented).

*Use of language is very dependent on programmer's*



9. a) How much have you spent in the last year on specifically increasing programmer productivity?

*For improvements to s/w production & ~~the~~ optimise resource but difficult to quantify.*

- b) What proportion of this was for DISER products?

*Just introduced N/A. ~~A/E~~.  
Cost of purchasing equip 300,000 FF.*

- c) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%  
5-14%  
15-25%  
25-49%  
50-99%  
100% or more

*N/A. s/w development is only  
( ) small part of budget. Have second  
( ) function ie experimental work for  
( ) Eurocontrol re general improvement  
( ) of s/w development.  
( )*

10. a) What do you consider to be the most valuable features of the DISER system as far as your company is concerned?

(In order of priority)  
1. Good environment for Modula 2  
2. Good editor.  
3. Advantages of linking to PDP11.  
4. (Useful re documentation)

*Re use for experiments  
1 Fully addressable screen.  
2 Window feature  
3 Interactive graphics  
4*

- b) What do you consider to be the greatest deficiencies of the DISER system at the moment as far as your company is concerned?

(In order of priority)  
1. Possible re networking *(not evident re. Ethernet)*  
2. Prob re copying disks *(just 1 disk station for cartridge).*  
3. Editor of compiler + text processing are different & less powerful than editor for mainframe.  
4. Complex procedure.  
5. Interested in colour screen re more commercial markets.



RESPONDENT

: Mr. KRELLA

TITLE

:

COMPANY

:

ADDRESS

:

CENTRE EXPERIMENTAL.  
EUROCONTROL.

B.P.15. 91220 BRÉTIGNY SUR ORG

TOTAL REVENUE OF COMPANY

:

TOTAL NUMBER OF COMPANY EMPLOYEES :

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

Re Diser market potential:

Would be more effective if could be, instead used as intelligent terminal linked to a mainframe/host computer.

Re. marketing

Need to improve market visibility & emphasise that the product is more than a personal computer.

Would not have large enough market to make it viable if only concentrated on universities.

*Sulzer*

SULZER  
#28

INPUT QUESTIONNAIRE

CATALOG NO. YDIS

STUDY TITLE : DISER/GENEVEST

TYPE OF QUESTIONNAIRE : USER

INPUT Ltd  
Airwork House  
Suites 101-110  
35 Piccadilly  
London W1V 9PB

TYPE OF S/W DEVELOPMENT

1. Class of Business

Excluding in-house data processing what type of product software development does your organisation undertake?

a) OEM?

Market Segment	% of Business	H/W	O/S	Language	Application

b) Embedded systems?

Application Type/Product	% of Business	H/W	O/S	Language

c) Product Software?

H/W	O/S	Language	Application	% of Business
Microprocessor	Prop.	Modula 2	as specified attached	100
Mini				
Mainframe				
Other - please specify				

ad 1.: to classify DISER application

System will be used in a stand-alone application in a staff department at the group headquarter in Winterthur. The tasks of the department are dedicated to security questions of nuclear technology, what is a product branch of Sulzer.

The first application is connected with wordprocessing:

- preparation of form masks
- capture and processing of process datas
- print out of the results in different styles and graphics on laser printer.

Further applications are planned, as:

- data bank processing:
  - storage and preparation of statistics and updates of the above mentioned datas
  - personal data bank: control of all employees in the nuclear area for medical purpose in cooperation with an insurance company.

As data bank system NIDAS will be used, developed at the ETH in Zurich under Professor Zehnder and Niffergeld.

(More about Nidas in "Neue Züricher Zeitung", vom Dec. 14. 1983, page 49)

The system is considered as the most advanced available, 4 to 5 years ahead to existing IBM DBMS.



2. FOR OEM BUSINESS ONLY:

a) Do you make or intend to make engineering changes to the DISER product?  
system is operated by enduser, no changes are done or planned

b) Do you attach your own or other manufacturers equipment to your systems?  
no in the moment

c) Are you looking for new OEM opportunities either in terms of markets or products?

Please give indication of what these are:

Markets: see: attachement

Products: \_\_\_\_\_

d) Do you have any specific criteria for new OEM products?

Operating System ( eg UNIX) X

Window Systems/Operating Environments

Languages (eg FORTRAN 77, PASCAL)

LAN protocols (eg ETHERNET)

Response time

Graphics (eg Resolution, Colour)

Mouse

Printing...: CRT display does not relate 1:1 zu print out

Memory Size

Disk Storage

Software Development (eg Speed of)

Price

Anything else

e) What do you find most restricting about the DISER equipment you are marketing as an OEM?

---

---

---

ad 2:

Though system is located on enduser site, some ideas of potential OEM us can be given:

System with the mentioned program applications could be included in a turnkey system together with the nuclear power part as the main product of Sulzer. More ideas and informations must be driven from the technical and marketing department of the division.

The further penetration as an enduser product within the company is dependen on rules of the installation of micro computer devices within the data processing system of the company. (Micro-Mainframe Connection). Such rules are under development but not existing.

A problem for DISER might come up: The system has no emulations for IBM compatibility and the system could be considered as an "exotic" device, though advantages of the system and its program language will be considered as extrem positive.

Advantages of Modula 2:

- its similarity to ADA:

ADA is still classified by the US GOvernment and not available in Europe. So programming can be done ADA-like through Modula 2.

M. has very powerful commands, is easy to learn and needs low memory capacities.

Problems, Advices:

Cross-Compiler for Fortran is needed, to use existing Fortran programs which ran on DEC computers.

Pascal as program language will be considered to implement easily.

Program language "C" should also be used, to have a UNIX connection.

To grant a permanent success for the DISER system, Program language Modula 2 should become more known in the computer world. Time problem: To penetrate a program language in the market it needs time: Pascal is available since 1972, but became well known in the last two years.

3.

a) How many software development programmers do you employ?

---

b) How many development m/c's do you have?

---

c) What is the approximate total spent on software development per annum?

---

d) Do you subcontract software development work to third parties?

---

e) If so, what proportion of the above is subcontracted?

---

f) What proportion of development is currently based on DISER equipment?

---

to questions 3 - 5:

The interview partner was an enduser of a stand alone Diser system. Questions only can be answered from the view of the individual user. The value of the answers are the experience less statistical estimations.

PRODUCTIVITY AIDS

6. a) What level of productivity improvement have you achieved through using MODULA 2 as a new language for development purposes?

Less than 5%	( )
5-14%	( )
15-25%	( )
25-49%	(X )
50-99%	( )
100% or more	( )

- b) How would you rate the quality of programs produced by MODULA 2?

extreme good

---

7. What level of productivity improvement have you achieved from using separate DISER machines for program development?

Less than 5%	( )	machine will not be used for
5-14%	( )	program developmen only, but more
15-25%	( X )	for routine workflow.
25-49%	( )	
50-99%	( )	
100% or more	( )	

8. How would you rate the following languages by the two parameters of Ease of Learning (for professional programmers) - ease of producing quality s/w.

Use a scale of 10 very easy to 1 very hard

	Relative Ease of Learning	Relative Ease of Producing Quality S/W
MODULA 2	4	3
COBOL		
BASIC	6	5
FORTRAN		
PASCAL		
ADA		
C		
CORAL ALGOL Other Languages		

(Note: do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented). answers depend on individual estimation



9. a) How much have you spent in the last year on specifically increasing programmer productivity?  
n.a.
- 

- b) What proportion of this was for DISER products?

the main proportion is dedicated to DISER

---

- c) What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

Less than 5%	( )
5-14%	n.a. ( )
15-25%	( )
25-49%	( )
50-99%	( )
100% or more	( )

10. a) What do you consider to be the most valuable features of the DISER system as far as your company is concerned?

1. \_\_\_\_\_ as mentioned under 2.

(In order of priority) 2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

- b) What do you consider to be the greatest deficiencies of the DISER system at the moment as far as your company is concerned?

1. \_\_\_\_\_

(In order of priority) 2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

<u>RESPONDENT</u>	:	<u>Mr. Lovis Pianta</u>
<u>TITLE</u>	:	<u>Department Manager KSFE-1505</u>
<u>COMPANY</u>	:	<u>Gebr. Sulzer AG</u>
<u>ADDRESS</u>	:	<u>CH 8401 Winterthur</u>
		<u> </u>
		<u> </u>
<u>TOTAL REVENUE OF COMPANY</u>	:	<u>n.a.</u>
<u>TOTAL NUMBER OF COMPANY EMPLOYEES</u>	:	<u>35.000</u>

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

## MARKET POTENTIAL

(User)

#29

SIGNETICS

1275 South 800 East

Orem UT 84058

Dr Robert Burton.

TYPE OF SOFTWARE DEVELOPMENT

## 1. Class of Business

- A. Excluding in-house data processing, what type of product software development does your organization undertake? *-internal only*

*Develop computer aided design system for signetics manufacturing*

- B. OEM? If OEM, please also answer question 2.

*user design product*

Market Segment	Percent of Business	Hardware	Operating Systems	Language	Application
_____	____%	_____	_____	_____	_____
_____	____%	_____	_____	_____	_____
_____	____%	_____	_____	_____	_____
_____	____%	_____	_____	_____	_____
_____	____%	_____	_____	_____	_____
Total	<u>100 %</u>				

What percent of your overall revenues does this business represent?

\_\_\_\_\_%

## C. Embedded Systems?

Application Type/Product	Percent of Business	Hardware	Operating Systems	Language
_____	____%	_____	_____	_____
_____	____%	_____	_____	_____
_____	____%	_____	_____	_____
_____	____%	_____	_____	_____
_____	____%	_____	_____	_____

What percent of your overall revenue does this business represent?

\_\_\_\_\_%

## D. Product Software?

*Duser User*

<u>Hardware</u>	<u>Operating Systems</u>	<u>Language</u>	<u>Application</u>	<u>Percent of Business</u>
Microprocessor		<i>Modula 2</i>	<i>CAD</i>	<i>100 %</i>
Mini Mainframe				<i>%</i>
Other (specify)				<i>%</i>

Total

*Software licensed to Duser for distributed* <sup>100 %</sup>

What percent of your overall revenue does this business represent?

*/* %

## 2. If OEM only:

A. Do you make or intend to make engineering changes to the Duser product?

\_\_\_\_\_

\_\_\_\_\_

B. Do you attach your own or other manufacturers equipment to your systems?

\_\_\_\_\_

C. Are you looking for new OEM opportunities either in terms of markets or products?

\_\_\_\_\_

Please give indication of what these are:

Markets: \_\_\_\_\_

Products: \_\_\_\_\_



D. Do you have any specific criteria for new OEM products?

Operating System (e.g. Unix) \_\_\_\_\_

Window Software \_\_\_\_\_

Languages (e.g., Fortran 77, Pascal) \_\_\_\_\_

LAN Protocols (e.g., Ethernet) \_\_\_\_\_

Response Time \_\_\_\_\_

Graphics (e.g., Resolution, Colors) \_\_\_\_\_

Mouse \_\_\_\_\_

Printing (e.g., Laser) \_\_\_\_\_

Memory Size \_\_\_\_\_

Disk Storage \_\_\_\_\_

Application Development (e.g., speed of) \_\_\_\_\_

Price \_\_\_\_\_

Other \_\_\_\_\_

\_\_\_\_\_

E. What do you find most restricting about the Diser equipment you are currently marketing as an OEM?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

CAD area only

3. A. How many software development programmers do you employ? ~ 2
- B. How many development M/C's do you have? 12  
(+ 7 on order)
- C. What is the approximate total dollars spent on software development per annum?  
\$ 100 - 150 K  
(45K machines) (3) *Exchanged software for machines*
- D. Do you sub-contract software development work to third-parties?  
no
- E. If so, what proportion of the above is subcontracted?  
—
- F. What proportion of development is currently based on Diser?  
100%

## 4. Software Development Productivity

- A. How would you rate the following major elements of software development in terms of their importance to your organization?

	Very Important	Important	Neutral	Not Important	
<i>most imp</i>					
* Specification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Programming	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Contruction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<i>Small group at Signetetics</i>
Documentation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Operation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

- B. What percent of the overall development is represented by programming, including compilation and testing of individual modules?

30%

Computer bills for Signetetics were \$20,000/mo

- 4 -

before we developed

CAD system on

Diser produced INPUT

5. Which of the following statements best fits your position with regard to programmer productivity?

- A. ☒ We measure programmer productivity  
 B. ☐ We have attempted to do this  
 C. ☐ We would like to  
 D. ☐ We do not measure it

If A., B., or C.:

E. How do you measure (or would like to) programmer productivity and what specific units are measured?

	<u>Comment</u>	<u>Specific Unit of Measurement</u>
Cost Related	<u>Measure in dollars</u>	<u>\$ savings</u>
Time Related	<u></u>	<u></u>
Quality Related	<u></u>	<u></u>

6. Productivity Aids:

Used to spend \$20,000 mo,  
now \$5,000 / YEAR

A. What level of productivity improvement have you achieved through using modula 2 as a language for development purposes?

- Less than 5% ☐  
 5-14% ☐  
 15-24% ☐  
 25-49% ☐  
 50-99% ☐  
 100% or more ☒

B. How would you rate the quality of programs produced by Modula 2?  
 (Scale 1-5: 1 = low quality, 5 = high quality)

5

most readable programs than  
any language can  
produce!

7. What level of productivity improvement have you achieved from using separate Diser machines for program development?

Less than 5% ☐  
5-14% ☐  
15-24% ☐  
25-49% ☐  
50-99% ☐  
100% or more ☒

8. How would you rate the following languages by the two parameters of ease of learning (for professional programmers) - Ease of producing quality software.

(Use scale 1-10 where 1 = very easy, 10 = very hard)

	<u>Relative Ease of Learning</u>	<u>Relative Ease of Producing Quality Software</u>
Cobol	<u>      </u>	<u>      </u>
Basic	<u>  1  </u>	<u>  10  </u>
Fortran	<u>  4  </u>	<u>  5  </u>
Pascal	<u>      </u>	<u>      </u>
ADA	<u>      </u>	<u>      </u>
C	<u>      </u>	<u>      </u>
Coral	<u>      </u>	<u>      </u>
Algol	<u>      </u>	<u>      </u>
Modula 2	<u>  3  </u>	<u>  1  </u>
Other Languages	<u>      </u>	<u>      </u>

*assuming lengthy programs*  
  
*{ BASIC:  
for one page programs is good*

(Note: Do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).



9. A. How much have you spent in the last year on specifically increasing programmer productivity? Bought 3 machines

B. What proportion of this was for Diser products? 100%

C. What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

		<u>Proportion</u>
Less than 5%	<input type="checkbox"/>	
5-14%	<input type="checkbox"/>	<u>N/A</u>
15-24%	<input type="checkbox"/>	
25-49%	<input type="checkbox"/>	
50-99%	<input type="checkbox"/>	
100% or more	<input type="checkbox"/>	

*Already have committed to Diser products. Consider them extremely cost effective*

10. A. What do you consider to be the most valuable features of the Diser system as far as your company is concerned?

Power for the price.  
Good speed at minimal cost.

B. What do you consider to be the greatest deficiencies of the Diser system, at the moment, as far as your company is concerned?

Lack of memory.

## MARKET POTENTIAL

(User)

UNIVERSITY OF COLORADO

Colorado Springs Co.  
Dr. Richard Weiner  
Dept. Computer Sciences.

TYPE OF SOFTWARE DEVELOPMENT

Also a professor in  
Computer Science Dept.

## 1. Class of Business

- A. Excluding in-house data processing, what type of product software development does your organization undertake?

Statistical software for microcomputers

- B. OEM? If OEM, please also answer question 2.

Market Segment	Percent of Business	Hardware	Operating Systems	Language	Application
_____	____%	_____	_____	_____	_____
_____	____%	_____	_____	_____	_____
_____	____%	_____	_____	_____	_____
_____	____%	_____	_____	_____	_____
_____	____%	_____	_____	_____	_____
Total	<u>100 %</u>				

What percent of your overall revenues does this business represent?

\_\_\_\_\_ %

## C. Embedded Systems?

Application Type/Product	Percent of Business	Hardware	Operating Systems	Language
_____	____%	_____	_____	_____
_____	____%	_____	_____	_____
_____	____%	_____	_____	_____
_____	____%	_____	_____	_____
_____	____%	_____	_____	_____

What percent of your overall revenue does this business represent?

\_\_\_\_\_ %

### D. Product Software?

<u>Hardware</u>	<u>Operating Systems</u>	<u>Language</u>	<u>Application</u>	<u>Percent of Business</u>
Microprocessor	<u>IBM PC</u>	<u>Modula 2</u>	<u>Statistical analysis</u>	<u>100 %</u>
Mini Mainframe	<u>                    </u>	<u>                    </u>	<u>                    </u>	<u>          %</u>
Other (specify)	<u>                    </u>	<u>                    </u>	<u>                    </u>	<u>          %</u>
<b>Total</b>				<b><u>100 %</u></b>

**What percent of your overall revenue does this business represent?**

100 %

2. If OEM only:

A. Do you make or intend to make engineering changes to the Diser product?

N/A

B. Do you attach your own or other manufacturers equipment to your systems?

---

C. Are you looking for new OEM opportunities either in terms of markets or products?

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Please give indication of what these are:

Markets: \_\_\_\_\_

**Products:** \_\_\_\_\_

D. Do you have any specific criteria for new OEM products?

Operating System (e.g. Unix) \_\_\_\_\_

Window Software \_\_\_\_\_

Languages (e.g., Fortran 77, Pascal) \_\_\_\_\_

LAN Protocols (e.g., Ethernet) \_\_\_\_\_

Response Time \_\_\_\_\_

Graphics (e.g., Resolution, Colors) \_\_\_\_\_

Mouse \_\_\_\_\_

Printing (e.g., Laser) *n/a* \_\_\_\_\_

Memory Size \_\_\_\_\_

Disk Storage \_\_\_\_\_

Application Development (e.g., speed of) \_\_\_\_\_

Price \_\_\_\_\_

Other \_\_\_\_\_

E. What do you find most restricting about the Diser equipment you are currently marketing as an OEM?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



3. A. How many software development programmers do you employ? 3
- B. How many development M/C's do you have? 1 (Sage)
- C. What is the approximate total dollars spent on software development per annum?  
\$ 100,000
- D. Do you sub-contract software development work to third-parties?  
no
- E. If so, what proportion of the above is subcontracted?  
N/A
- F. What proportion of development is currently based on Diser?  
None currently. But we do want to use Diser hardware once the product is modified to communicate with other machines in the industry.
4. Software Development Productivity We are very impressed with the goals of the company
- A. How would you rate the following major elements of software development in terms of their importance to your organization?

	Very Important	Important	Neutral	Not Important
Specification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Programming	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Contruction	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verification	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- B. What percent of the overall development is represented by programming, including compilation and testing of individual modules?

20%

*(60% should be specification and design, then programming can follow)*

5. Which of the following statements best fits your position with regard to programmer productivity?

- A. ☒ We measure programmer productivity
- B. ☐ We have attempted to do this
- C. ☐ We would like to
- D. ☐ We do not measure it

If A., B., or C.:

E. How do you measure (or would like to) programmer productivity and what specific units are measured?

	<u>Comment</u>	<u>Specific Unit of Measurement</u>
Cost Related		
Time Related	<u>Partition design into modules and measure productivity by days to complete each module</u>	<u>Days per module</u>
Quality Related		

6. Productivity Aids:

A. What level of productivity improvement have you achieved through using modula 2 as a language for development purposes?

- Less than 5% ☐
- 5-14% ☐
- 15-24% ☐
- 25-49% ☐
- 50-99% ☐
- 100% or more ☒

"We have actually doubled our productivity"

B. How would you rate the quality of programs produced by Modula 2? (Scale 1-5: 1 = low quality, 5 = high quality)

5

7. What level of productivity improvement have you achieved from using separate Diser machines for program development? *NOT APPLICABLE*

Less than 5% ☐  
 5-14% ☐  
 15-24% ☐  
 25-49% ☐  
 50-99% ☐  
 100% or more ☐

8. How would you rate the following languages by the two parameters of ease of learning (for professional programmers) - Ease of producing quality software.

(Use scale 1-10 where 10 = very easy, 1 = very hard)

	Relative Ease of Learning		Relative Ease of Producing Quality Software	
Cobol	<u>no experience</u>			
Basic	<u>1</u>	<u>10</u>	<u>10</u>	<u>1</u>
Fortran	<u>6</u>	<u>4</u>	<u>8</u>	<u>2</u>
Pascal	<u>3</u>	<u>7</u>	<u>3</u>	<u>7</u>
ADA	<u>10</u>	<u>1</u>	<u>6</u>	<u>4</u>
C	<u>7</u>	<u>3</u>	<u>7</u>	<u>3</u>
Coral	<u>unknown</u>			
Algol	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>
Modula 2	<u>4</u>	<u>6</u>	<u>1</u>	<u>10</u>
Other Languages	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>

(Note: Do not need to answer for all languages. Quality software would imply - efficient code, easy to amend and update, easily documented).

9. A. How much have you spent in the last year on specifically increasing programmer productivity?

15%

(\$15,000)

- B. What proportion of this was for Diser products?

no hardware

- C. What proportion of your overall development budget would you be prepared to spend on increasing programmer productivity to achieve the following productivity improvements?

		<u>Proportion</u>
Less than 5%	<input type="checkbox"/>	<u>0</u>
5-14%	<input type="checkbox"/>	<u>5%</u>
15-24%	<input type="checkbox"/>	<u>10%</u>
25-49%	<input type="checkbox"/>	<u>15%</u>
50-99%	<input type="checkbox"/>	<u>20%</u>
100% or more	<input type="checkbox"/>	<u>25%</u>

10. A. What do you consider to be the most valuable features of the Diser system as far as your company is concerned?

The modula 2 language, library, software tools definitely creates an environment that supports systems development. no question about it!

- B. What do you consider to be the greatest deficiencies of the Diser system, at the moment, as far as your company is concerned?

At the moment Diser products (w/ hardware) are unable to communicate with the rest of the computer world. If I create my software on their machine, it is not readily transferrable to other computers. That is why I use the Sage w/ Modula 2 for the IBM PC. Once Diser overcomes this, we will definitely use the product.





